WHAT IS JAPAN'S ADVANTAGE IN THE COMMERCIALIZATION OF TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON
TECHNOLOGY AND COMPETITIVENESS

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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WHAT IS JAPAN'S ADVANTAGE IN THE COMMERCIALIZATION OF TECHNOLOGY?

TUESDAY, APRIL 30, 1991

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Technology and Competitiveness,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:40 a.m., in room 2325, Rayburn House Office Building, Hon. Tim Valentine [chairman of the subcommittee] presiding.

Mr. Valentine. Good morning, ladies and gentlemen.

This morning, the Subcommittee on Technology and Competitiveness will explore those factors that appear to have contributed to Japan's emergence as a superpower in the production of innovative and high quality products.

During the past four decades, we have watched a metamorphosis of the term "Made in Japan." Most of those present remember the first feeble products to emerge from post-war Japan which were uniformly cheap and poorly made. Some of us remember products that were produced by Japan before World War II, and the same thing applied, I suggest. Yet from the 1980's on, "Made in Japan" has meant the opposite. The Acura and Lexus are challenging long established luxury automobiles. New electronic wonders emerge from Japan like clockwork. Even Steinway—Steinway pianos and Cray supercomputers are beginning to feel the heat from Japanese competitors. The Japanese have pulled off an economic miracle in the past decade.

The Council on Competitiveness, a U.S. business group, released a report last month which was entitled "Gaining new ground: Technology priorities for America's future," which asks one basic question: Do our current national policies and priorities adequately address the commercial technology challenge facing the United States? Their conclusion was that they do not.

It is high time that we understood exactly how the Japanese achieved their success. How can they, with such great regularity, take American inventions, like the television, the VCR, the compact disk, and turn them into billion-dollar industries?

This morning, this subcommittee will focus on Japan's national policies and priorities and attempt to determine what factors have contributed to Japan's commercial success. I believe this to be, if not the first time, one of the few times that a committee or subcommittee of the Congress has undertaken to dissect the problem and to get information in the categories one, two, three, four—what is it that they do that we don't do?

Our expert witnesses will examine these policies and compare the Japanese government-business relationship to that which exists in the United States. We look forward to the comments of the witnesses and to their enlightening testimony and receiving therefrom clues from which, hopefully, we will be able to find solutions to this problem.

We will, I am sure, have additional members of the subcommittee join us as we wend our way through this testimony. This is something of a day of travel for a lot of Members returning from their districts, so I am sure we will be joined by others, as this has been a well publicized and, to us, a very important exercise, and the chair will recognize at this time the very distinguished ranking member of the subcommittee, the gentleman from Florida, Mr. Tom Lewis.

Mr. LEWIS. Thank you, Mr. Chairman, and good morning.

Mr. VALENTINE. I feel good this morning.

Mr. LEWIS. Yes. I'm glad you feel good this morning.

Few issues generate more public interest than the U.S.A.-Japan competitiveness. This past weekend, I saw articles on U.S.-Japan trade negotiations, on access to Japan's construction market "U.S.-Japan negotiations are close to reaching a new agreement on trade in semiconductors;" a report from the Brookings Institution that Japanese corporate giants restrict the flow of foreign goods into Japan; and a statement by T. Boone Pickens on why he can't fight Japan's cartel system.

My interest in Japanese competitiveness is not new. For example, in 1989 I took a strong position in opposition to the proposed joint U.S.-Japan FSX fighter aircraft technology development project. I became convinced that the U.S.A. would give away the aeronautical knowledge base in exchange for a few technological gains, and I continue to be concerned about both the short- and long-term impacts of any international technology agreement. We have not always looked at the long-range impacts of these agreements, including those in automotive and semiconductor technologies.

I would be interested to hear today what has to be said on both sides of the issue both from the American entrepreneurs and also from others, looking as to how we can open the gates so that we have free and fair trade to open the door of competitiveness with Japan.

So, Mr. Chairman, I look forward to learn from the Japanese model how to improve competitiveness today.

Mr. VALENTINE. Thank you, Mr. Lewis.

[The prepared statements of Mrs. Morella and Ms. Horn follow:]

Constance Morella

OPENING STATEMENT, THE HONORABLE CONSTANCE A. MORELLA

HEARING, SUBCOMMITTEE ON TECHNOLOGY AND COMPETITIVENESS

APRIL 30, 1991, 9:30 A.M.

MR. CHAIRMAN, I WANT TO THANK YOU FOR CONVENING THIS MORNING'S HEARING ON THE IMPORTANT AND TIMELY TOPIC OF "WHAT IS THE

JAPANESE COMMERCIAL ADVANTAGE?" IT IS PARTICULARLY TIMELY AS WE MOVE CLOSER TO TRADE AGREEMENTS WITH THE JAPANESE ON THE SEMICONDUCTOR INDUSTRY, A KEY CRITICAL TECHNOLOGY AND ONE IN WHICH U.S. COMPETITIVE ADVANTAGES HAVE CLEARLY BEEN THREATENED.

I AM PLEASED TO BE HERE TODAY TO DISCUSS THE IMPACT JAPANESE COMMERCIAL AND INDUSTRIAL PRACTICES AND ADVANTAGES HAVE ON JAPAN'S

DRAMATIC COMPETITIVE GROWTH IN CRITICAL TECHNOLOGIES AS WELL AS ON OUR OWN COMPETITIVE STANDING. I CONFIDENTLY EXPECT THERE ARE MANY AREAS WHERE WE CAN COMPETE EFFECTIVELY WITH THE JAPANESE--FOR EXAMPLE, BIOTECHNOLOGY HOLDS SUCH PROMISE AND WE ARE CLEARLY LEADING THE WAY. I HOPE TODAY'S TESTIMONY WILL SHED SOME LIGHT ON WAYS IN WHICH WE CAN LEVEL THE PLAYING FIELD IN CRITICAL TECHNOLOGY AREAS IN WHICH WE ARE BEHIND, OR FALLING BEHIND, AND

WAYS IN WHICH WE CAN MAINTAIN OR ACCELERATE LEADS IN CRITICAL TECHNOLOGIES IN WHICH WE ARE ALREADY AHEAD.

THE PURPOSE OF THE HEARING TODAY IS TO TAKE A LOOK AT THE STRENGTHS AND WEAKNESSES OF U.S. TECHNOLOGICAL COMPETITIVENESS. THERE ARE SOME KEY TRENDS THAT NEED TO BE CONSIDERED AS WE UNDERTAKE THAT ASSESSMENT, ESPECIALLY RELATIVE TO THE UNITED STATES' POSITION IN THE

22 CRITICAL TECHNOLOGIES ANNOUNCED IN THE MARCH 1991 REPORT OF THE NATIONAL CRITICAL TECHNOLOGIES PANEL. SOME OF THESE TRENDS INCLUDE:

*THE UNITED STATES HIGH-TECHNOLOGY INDUSTRY, INCLUDING THE DEFENSE SECTOR, HAS BECOME INCREASINGLY GLOBALIZED.

*AS A RESULT, THE UNITED STATES CAN NO

LONGER THINK EXCLUSIVELY IN AMERICAN TERMS AS BEING THE SOLE PROVING GROUND FOR HIGH TECHNOLOGY.

*IN ADDITION, THERE IS GROWING CONSENSUS THAT COMMERCIAL ECONOMIC COMPETITIVENESS AND NATIONAL SECURITY ARE INEXTRICABLY LINKED.

*COMMERCIAL AND MILITARY SECTORS ARE INCREASINGLY OVERLAPPING, WITH SOME OF THE

MOST CRITICAL DUAL-USE TECHNOLOGIES COMING OUT OF THE COMMERCIAL SECTOR.

*CORRESPONDINGLY AND MORE THAN A BIT ALARMINGLY, WITH INCREASING FREQUENCY FOREIGN COMPETITORS OF THE UNITED STATES, MOST NOTABLY JAPAN, ARE THE FIRST TO APPLY ADVANCED DUAL-USE TECHNOLOGIES FOR COMMERCIAL OR MILITARY PURPOSES.

*AS GLOBAL, COMMERCIAL, AND MILITARY INTEGRATION PROCEEDS, U.S. PREEMINENCE IN CRITICAL TECHNOLOGIES IS RAPIDLY ERODING, AND, IN SOME CASES, IS DISAPPEARING ALTOGETHER--ONE NEED ONLY GLANCE AT THE COUNCIL ON COMPETITIVENESS' RECENT REPORT "GAINING NEW GROUND" TO SEE THIS TREND DOCUMENTED FOR CRITICAL COMMERCIAL TECHNOLOGIES OR AT THE DEPARTMENT OF DEFENSE'S MOST RECENT DEFENSE

CRITICAL TECHNOLOGIES PLAN WHICH PLACES JAPAN AHEAD, OR ON PAR, WITH THE U.S. IN SEVEN OF 20 CRITICAL TECHNOLOGIES.

THERE ARE A VARIETY OF WAYS IN WHICH CONGRESS CAN ENCOURAGE A SOUNDER APPROACH TO TECHNOLOGY POLICY IN THE U.S. TO SHORE UP OUR COMMERCIAL AND INDUSTRIAL COMPETITIVE ADVANTAGES VIS-A-VIS JAPAN AS WELL AS OTHER WORTHY COMPETITORS. FOR EXAMPLE, FIRST, WE

NEED TO IMPROVE RESEARCH AND DEVELOPMENT IN CRITICAL TECHNOLOGIES AND PROVIDE INCENTIVES FOR QUICKER APPLICATIONS OF THOSE TECHNOLOGIES AS MY RECENT LEGISLATION TO ENHANCE TECHNOLOGY TRANSFER WITHIN OUR FEDERAL LABORATORIES SEEKS TO DO. SECOND, WE NEED TO ENCOURAGE INTERNATIONAL TECHNOLOGY TRANSFER OPPORTUNITIES AND JOINT VENTURES WHERE THE TRANSFER OF KNOWLEDGE IS FAVORABLE TO BOTH PARTIES AND DOES NOT JEOPARDIZE KEY LEADS.

THIRD, WE MUST IMPROVE AND ACCELERATE EDUCATION OPPORTUNITIES IN SCIENCE AND MATH IF WE ARE TO COMPETE EFFECTIVELY. FINALLY, WE MUST LOOK AT WAYS IN WHICH TO OPEN OUR COMPETITORS' MARKETS AND LEVEL THE PLAYING FIELD.

MR. CHAIRMAN, AGAIN, I THANK YOU FOR THE OPPORTUNITY TO MAKE A FEW REMARKS THIS MORNING AND FOR HOLDING THIS ESSENTIAL HEARING. I LOOK FORWARD TO THE TESTIMONY OF OUR DISTINGUISHED WITNESSES.

STATEMENT OF REP. HORN BEFORE SUBCOMMITTEE ON TECHNOLOGY AND COMPETITIVENESS

APRIL 30,1991

Mr. Chairman, distinguished colleagues, and members of the panel,

Americans are becoming aware of the strongly competitive international business environment. As workers are laid off, and jobs move overseas, they wonder what happened to the American lead in manufacturing, which helped build the strongest economy in the world.

During the 1940's, '50's, and '60's, U.S. firms built the strongest manufacturing base on earth. Our industries produced steel for cars, buses and train. Our televisions, radios, and other consumer goods were known for their state of the art quality and durability. At that time "made in Japan" was synonymous with cheap, inferior products.

Because of the preeminent quality of our products, and our positive balance of trade, our standard of living was the envy of the world. We led the world in per capita income, in home ownership, and in quality of life. Our people enjoyed increasing life expectancy, our infant mortality was low, and parents could look to the future with hope that their children's standard of living would be as higher as or higher than theirs. In short, the American dream was prospering.

Today Americans wonder what happened to this dream. As Germany, Japan, and Korea capture our domestic markets for consumer goods, Americans go to the store to see only foreign produced products on the shelves. Companies once known for American quality products now make their goods overseas. As our people wonder what happened to American knowhow, we, as leaders must look for answers to regain our preeminence as world leaders in industry.

We must learn how we lost our lead in the automotive and other heavy manufacturing industries. In addition, we must determine how to regain our competitiveness in these industries, without repeating the same mistakes in the aerospace, computer, and other technological industries. We must learn to plan for the future; looking only a few months or a few years down the road is not sufficient vision to maintain leads in technologies and industries which have decade-long lead times.

It is time to take a hard look at the way we run our industries in this country. To do this requires that we compare our policies with those of other nations to see where the relative strengths lie. We must look at the role of government and government-industry partnerships to ascertain what works and what doesn't. Once we have fully examined how the organization, research and development, and commercialization processes work in various nations' enterprises, we can see how to apply this knowledge to our own commercial sector. By choosing organization and commercialization options which best fit our specific governmental and cultural heritage, we can start to regain our competitiveness in the world market.

I look forward to hearing the testimony of today's witnesses as they discuss Japan's current advantage in the commercialization of technology. I hope that from this hearing we can obtain a full picture of how the U.S. might use its strong technological base to develop a more competitive international stance in the marketplace.

Mr. VALENTINE. We hope to have a relatively informal give and take, so we have asked the witnesses to all come up to the table together in one panel, and I will undertake to introduce them at this time.

The first witness is Mr. Dick K. Nanto, who is a specialist in industry and trade, Economics Division, Congressional Research Service, which is a part of the Library of Congress. Next to him is Mr. Allan I. Mendelowitz, who is director, international trade, energy, and finance issues. U.S. General Accounting Office; Mr. David W. Cheney, senior associate, Council on Competitiveness; Mr. Justin Bloom, president of Technology International, Inc; and Ms. Mindy L. Kotler, who is president of Search Associates, Inc.

We welcome each of you here, and we request that you summarize your testimony. Your prepared statements will appear in the record as presented to us.

Mr. Nanto.

STATEMENTS OF DICK K. NANTO, SPECIALIST IN INDUSTRY AND TRADE, ECONOMICS DIVISION, CONGRESSIONAL RESEARCH SERVICE, LIBRARY OF CONGRESS, WASHINGTON, D.C.; ALLAN I. MENDELOWITZ, DIRECTOR, INTERNATIONAL TRADE, ENERGY, AND FINANCE ISSUES, U.S. GENERAL ACCOUNTING OFFICE, WASHINGTON, D.C.; DAVID W. CHENEY, SENIOR ASSOCIATE, COUNCIL ON COMPETITIVENESS, WASHINGTON, D.C.; JUSTIN BLOOM, PRESIDENT, TECHNOLOGY INTERNATIONAL, INC., POTOMAC, MARYLAND; AND MINDY L. KOTLER, PRESIDENT, SEARCH ASSOCIATES, INC., WASHINGTON, D.C.

Mr. NANTO. Thank you, Mr. Chairman. I would like to thank the subcommittee for the invitation to testify in this hearing and commend it for addressing this important topic.

My statement deals with the business environment in Japan and how it affects the commercialization of technology. In the world today, many images exist that carry distinct messages. As our troops have returned from the Gulf, they have flashed the V sign for victory, and in sports events we are accustomed to seeing fans with oversized rubber hands with an index finger pointing up, chanting, "Number one; number one." In high technology products, however, an image seems to be appearing nowadays that represents something more foreboding, and I call it an ominous X. These ominous X's can be seen with increasing frequency in graphs of world market shares of various high technology products. In these graphs, America's market share seems to be falling while the Japanese share is rising, and eventually they cross to form an X.

Well, the success for Japanese businesses has not come by accident. Over the past four decades, Japan's businesses have undergone a complete transformation, and a key to this transformation has been in developing their ability to commercialize and improve on new technology. This transformation has been supported by institutions and forces in the Japanese business environment.

Now, on the surface, the American and Japanese business environments seem to be about 90 percent the same, but they differ in all their important characteristics. In the brief time allotted to me today, I would like to address just three of the elements of this environment: Japan's macro economy, business-to-business ties, and international trade.

Now, any firm must operate in the macro-economic environment in the nation in which it is located. Japan's macro economy can be characterized by high rates of economic growth; relatively low interest rates, although real interest rates in Japan now are roughly equivalent to those in the United States; low inflation; and an appreciating currency. Each of these affects the strategies and competitive thrusts of a firm.

Since the end of World War II, Japan has grown at surprisingly high rates. This rapidly expanding economy has compelled firms to adopt strategies aimed at establishing and protecting market share rather than maximizing short-term profits. The risk for Japanese businesses has been on the side of expanding too slowly rather than too fast. The Japanese business landscape is littered with the bodies of firms that have not maintained their market share even though short-term profits were high.

This attention to market share requires that Japanese firms continually search for new technology and products. It also has compressed product cycles in Japan, has forced firms to expand production and move down their long-run cost curves in order to underprice competitors.

Increasing production, however, requires massive investments in new plants and equipment. A company does not double production in Japan by working existing machines twice as long, it builds another factory, and this, of course, requires money. The relatively low rates of interest in Japan have made it easier for firms to finance purchases of new capital equipment.

Firms in Japan now are spending phenomenal amounts of money on new equipment. During 1990, they spent nearly a trillion dollars on new plants and equipment. This amounted to about a quarter of a trillion more than was spent in the United States and more than twice the U.S. amount when computed on a per-worker basis.

Needless to say, new equipment brings new technology since most new technology today is embodied in equipment. The high rate of investment by Japanese firms, therefore, gives them a major advantage in incorporating new technology and continually upgrading their products.

Let me turn to business ties. Business-to-business ties in Japan constitute a second important external environment for firms. Among the Japanese, relationships tend to be long term, and this is epitomized by Japan's industrial groups, or the keiretsu. These industrial groups consist of two types; there are conglomerates, and there are those that are vertically integrated. The conglomerate keiretsu are families of companies with members in diverse industries and usually have a bank or a trading company at the center. These include companies like Mitsubishi, Mitsui, Sumitomo, and three other major conglomerate keiretsu.

If you look at the Mitsubishi group, you will see Mitsubishi Trading Company at the center, the bank—Mitsubishi Bank—and Mitsubishi Heavy Industries, and about 35 other companies in various industries that belong to that family.

The conglomerate keiretsu tie their firms together by cross-holding shares, by having inter-group financing by a common bank, by using their trading company to market and organize products and organizing projects, and they also have joint investments in new technologies. The extent of stock cross-holding is about 14 to 22 percent.

In terms of the commercialization of technology and product development, the share cross-holdings ease the pressure for short-term results and enhance cooperation among member companies in different industries. Japanese business executives claim that such stable share-holdings allow company management to devote more attention to longer-term product development rather than to activities that might bolster the bottom line.

The main banks in the keiretsu not only hold shares of the member companies but individual companies rely on them for as much as 30 percent of their loans. The conglomerate keiretsu, therefore, have deep pockets for financing R&D. They often will join sister firms in joint R&D projects and compete intensively with other keiretsu across many industries. This means they can ill afford to fall behind in an emerging technology.

Well, in addition to the huge conglomerate keiretsu in Japan, there are numerous vertically integrated groups. These independent groups resemble those large corporations that you see anywhere else in the industrialized world. But, unlike the conglomerates, these are usually concentrated in one or a few industries and emphasize vertical relationships. You have a major company like Toyota, or Honda, or Sony, and under that company there will be many supplier companies that belong to this family.

As with the conglomerate keiretsu, the vertical keiretsu firms hold each other's stock, exchange information, and cooperate in new ventures. Since the relationship is vertical, however, the closest ties are between buyers and suppliers, the final manufacturer and its supplier, and the final manufacturer will cooperate extensively with suppliers in upgrading the technology, the manufacturing process, and implementing quality control, so the supplier becomes an integral link in the commercialization of new technology.

In automobile technology, companies such as Honda and Toyota have used their family of suppliers to generate the improvements needed for new generations of cars. Given the high reliance on outside suppliers for parts, Japanese auto makers have pushed much of that task of incorporating new technology down to supplier firms.

Let me end by looking briefly at the international trade environment. A discussion of trade in the commercialization of technology is usually couched in terms of the degree of protection from imports or the flows of high technology products into the country. There is little doubt that Japan has imported much technology from abroad and continues to do so. There also is little doubt that a prominent tool in the kit used by Japan's government in its industrial policy is the protection of infant industries. The number of such protected industries, however, is diminishing rapidly, and U.S. pressure for market opening is gaining access for U.S. exports of satellites and other industries that are still developing in Japan.

For Japanese companies, however, international trade plays a further important role. Most firms view their potential market as the world either directly or through a final manufacturer. World markets serve as a source of ideas for product development, as a standard by which productivity can be measured, and an outlet to absorb production from the ever growing manufacturing capacity at home. Japan's manufacturers definitely do not suffer from the "not invented here" syndrome. They scour the world for information and ideas. Their competitive benchmarking of measures of productivity, efficiency, and quality control, moreover, tend to be world standards and not just local ones. Roles of market share now extend to foreign markets. Japanese companies battle each other as intensively in the United States and Europe as they do at home.

Let me summarize by saying that the Japanese business environment helps firms to commercialize new technology in three major ways. First, it provides an economic environment conducive to long-term development. High economic growth combined with relatively low rates of interest have helped firms make the investments needed to adopt new technology and to protect market share. Second, the business environment threatens them with extinction if they do not keep up. Competition within Japan, particularly among the keiretsu groups, is so intense that any company losing market share over an extended period of time will soon be out of that line of business. And, third, the business environment provides a structure that lessens the risks of failure in commercialization efforts. The family groups with cross-shareholdings of stock and a bank to shore up the financial supports allow companies to take a longer-term view of product development.

Thank you.

[The prepared statement of Mr. Nanto follows:]

Japan's Business Advantage in Commercializing Technology

Testimony prepared for the
House Committee on Science, Space, and Technology
Subcommittee on Technology and Competitiveness

Dick K. Nanto
Head, Japan Task Force and
Specialist in Industry and Trade
Economics Division
Congressional Research Service

April 30, 1991

INTRODUCTION

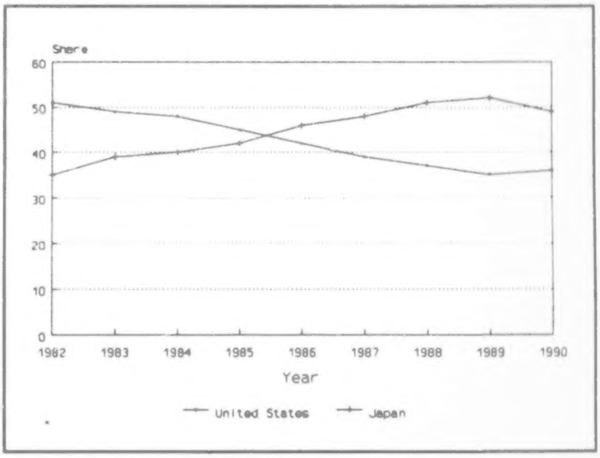
I would like to thank the Committee for the invitation to testify in this hearing and commend it for addressing this important topic. My statement deals with the business environment in Japan and how it affects the commercialization of technology.

In the world today, many images exist that carry distinct messages. As troops have returned home from war in the Gulf, they have flash the "V" sign for victory. In sports events, we are accustomed to seeing fans with oversized foam rubber hands with an index finger pointing up chanting "number one, number one."

In high-technology products, however, an image keeps appearing that represents something more foreboding. I call it an "ominous X." These "ominous X's" can be seen with increasing frequency in graphs of world market shares of various high technology products. In these graphs, American market share is falling, while the Japanese share is rising. Eventually these lines cross to form the X.

Figure 1 shows such a graph for semiconductor devices. Similar X-shaped graphs are now developing in industries such as computers, telecommunications equipment, medical equipment, and instrumentation and control devices. Furthermore, in certain products, such as compact disk players, video cassette recorders, and video cameras, only half an X appears. U.S. firms have virtually no market share at all, except in products actually made by foreign supplier firms but carrying the U.S. brand name.

FIGURE 1. World Market Shares in Semiconductors, United States and Japan



JAPAN'S BUSINESS ENVIRONMENT

Success for Japanese businesses has not come by accident. The path away from the cheap toys and imitation Singer sewing machines of the 1950s has been arduous. Over the past four decades, Japan's businesses have undergone a complete transformation. A key to this transformation has been in developing their ability to commercialize and improve on new technology, and this transformation has been supported by institutions and forces in the Japanese business environment.

Let me preface these remarks by saying that I tend to discount the argument that Japanese business successes can be explained in cultural terms. While there is no doubt that Japan is different, and the market there is difficult to crack, Japanese culture has been around for a long time. The same culture that brought the world the instantly breakable toys of the 1950s now brings you the Nintendo video games of the 1990s. Cultural explanations hold a certain allure, but businesses develop not because of culture but because of economic incentives, forward looking management, and internal and external pressures.

In today's new world of global markets, low border barriers, and corporations whose activities span many nations, the competitive firm must be able to keep up with the world's best in two ways. It first must be able to bring to fruition new products using new technology. This means commercializing new discoveries or using new scientific knowledge in the production process. This, however, is only the beginning. Every new product or manufacturing process invites a host of imitators. In manufactured products, in particular, sophisticated reverse engineering allows almost anything to be duplicated, sometimes in just a few months. The commercial rewards, therefore, go mainly to the companies that can continually improve on products, move down their long-run cost curves to reach economies of scale in production, and constantly innovate to miniaturize, simplify, add features, increase value, and capture world market share. The original inventors receive some royalty payments, but the larger rewards tend to go to the manufacturers. The technology to be commercialized tends not to be a blueprint; it is a process.

Over the past 40 years, Japan has developed a business environment that supports and enhances this commercial activity. This business environment is based on a few fundamental premises:

- Competitive advantage in any manufacturing industry can be created.
- The true measure of the viability of an industry is its success in world markets. Japan must export to survive.
- For living standards to increase, production must first rise. Consumption then will follow.
- Competition is the mother of invention, commercialization, and progress. But too much competition can be debilitating.
- Government can play an important role during the infancy and early commercialization and also during the declining years of an industry.

BUSINESS ENVIRONMENT

These premises underlie a fairly distinctive business environment in Japan. While the individual parts of this environment seem familiar, the systematic effects on businesses operating in this environment can be surprising. The American and Japanese business environments are about 90 percent the same, but they seem to differ in all their important characteristics. This environment includes the macroeconomic milieu, business-to-business ties, international trade environment, the labor market, and relations with the government. In the brief time allotted to me today, I would like to address just three of these environments: Japan's macroeconomy, business-to-business ties, and international trade.

Macroeconomic Environment

Any firm must operate in the macroeconomic environment of the nation in which it is located. Japan's macroeconomy can be characterized by high rates of economic growth, relatively low interest rates (although real interest rates in Japan now are roughly equivalent to those in the United States), low inflation, and an appreciating currency. Each of these affect the strategies and competitive thrusts of a firm.

Since the end of World War II, Japan has grown at surprisingly high rates. Economic growth now has slowed from the double digit levels common during the 1950s, 1960s, and into the 1970s, but even the 3 percent growth rate expected during this recessionary year is remarkable. This continual record of high growth compelled firms to adopt strategies aimed at establishing and protecting market share rather than maximizing short-term profits. The risk for businesses has been on the side of expanding too slowly rather than too fast. Falling behind in competition threatens the long-term viability of a company more than the financial risks of expanding ahead of demand. The Japanese business landscape is littered with the bodies of firms that have not maintained their market share, even though short-term profits were high.

This attention to market share requires that Japanese firms continually search for new technology and products. Few firms have cash cows that keep generating profits year after year. Most products are like flowers. They are planted, and they grow, bloom, and die. A firm can nurture its flowers to make them grow taller or bloom longer, but eventually even the markets for products as solid as that of 21-jewel watches wither away. It is not surprising that Japan's Seiko Watch company shifted its focus from mechanical to quartz movements and then converted much of its intricate watch-making skills to making Epson dot-matrix printers.

The race for market share in Japan keeps compressing product cycles. When Molex, an American maker of electrical connectors, began operating in Japan, it was astounded to find that it had to reduce its new product cycle to six months for its Japanese customers, while in the United States twelve months was the norm, and eighteen months was acceptable in Europe. It adapted and reported over $300 million in sales in Japan in 1990.[1]

A critical component in the success of a company in maintaining its market share is its ability to move down its long-run cost curve and underprice its competitors. In product after product, Japanese companies have discovered that as they gain production experience, average costs will fall. This occurs because experience smooths disruptions, but also because quality rises and waste is reduced. If the third time is the charm, the three-thousandths or three-millionth time is a snap. High production runs, moreover, gain from the usual economies of large-scale production.

Such large-scale production, however, requires massive investments in new plant and equipment. A company does not double production by working existing machines twice as long. It builds another factory. This requires money.

The relatively low rates of interest in Japan have made it easier for firms to finance purchases of new capital equipment. Firms in Japan now are spending phenomenal amounts of money on new plant and equipment. During 1990, businesses there spent nearly a trillion dollars on fixed capital formation. This amounted to about a quarter trillion dollars more than was spent on new capital equipment in the United States and more than twice the U.S. amount when computed on a per-worker basis. Fixed investment in Japan accounted for 33 percent of GNP as compared with about 14 percent in the United States.

These disparities in purchases of new machines for production means that if U.S. firms think competition from Japanese firms is intense now, just wait until this new capacity comes on line. Needless to say, new equipment brings new technology, since most technology today is embodied in equipment. The high rate of investment by Japanese firms, therefore, gives them a major advantage in incorporating new technology and continually upgrading their products.

The low inflation rates in Japan (3.1 percent in consumer prices in 1990) provides for stability and predictability and helps keep worker demands for wage increases moderate. Japan did have severe inflation following the first oil crisis in 1973. Over the 1980s, however, consumer prices in Japan rose by 22.5 percent as compared with 58.6 percent in the United States.

The appreciating yen in foreign exchange markets has turned out to be both a curse and a blessing for Japanese firms. Between 1985 and 1987, the yen/dollar exchange rate dropped by 40 percent from 238 to 144 yen per dollar. While placing constant pressure on firms to reduce costs and add value to their products, it also has lowered the cost of imports of raw materials, components, and capital goods. While the victory in the Gulf War along with the recession in the United States recently has sent the yen down somewhat, the long-term trend is upward. This has forced Japanese firms to make hard decisions about products and technology development that otherwise might have been postponed. As Michael Porter stated in his study of the competitive advantage of nations, "Few companies make significant improvements and strategy changes voluntarily; most are forced to. The pressure to change is more often environmental than internal."[2]

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[1] Morgan, James C. and J. Jeffrey Morgan. *Cracking the Japanese Market.* New York, The Free Press, 1991. p. 99.

The 1980s also taught Japanese business an important lesson: the nation that is first in the marketplace with a hot product often can dominate that market for a long time. Consider the home video cassette recorder. It is not that firms cannot duplicate this product. In fact, many Japanese and now South Korean firms make them. The battle between Sony with its beta format and Matsushita with its VHS format has been of epic proportions. The problem that foreign firms face in making VCRs is that most of the parts suppliers are located in Japan. They are clustered around the major Japanese producers. Foreign firms can make VCRs, but not as cheaply or with the technical innovations of the major Japanese suppliers.

Being first with a product also endows that product with a special cachet in Japan. There are rewards for being first. In the minds of many, the Sony Walkman is still the only true walkman. Everything else is a Walkman-like product. The Sony still carries a price premium. Combined with the appreciating yen, this has added to the forces inducing companies to be the first on the market with a new product or one using new technology.

Business Ties

Business-to-business ties in Japan constitute a second important external environment for firms. Among Japanese, relationships tend to be long-term, and links are cultivated and fostered. Both people and firms neither enter into nor terminate relationships casually. These long-term relationships are epitomized in Japan's industrial groups, or the *keiretsu*. These industrial groups consist of two types: conglomerates and those vertically integrated.

The conglomerate *keiretsu* are families of companies with members in diverse industries and usually with a bank and trading company at the center. These include Mitsubishi, Mitsui, Sumitomo, Fuyo, DKB, and Sanwa. The well-known Mitsubishi Group, for example, is centered on the Mitsubishi Corporation (a trading company), Mitsubishi Bank, and Mitsubishi Heavy Industries. The affiliated Mitsubishi companies include 35 firms in insurance, construction, food, textiles, paper, chemicals, petroleum, glass, cement, steel, nonferrous metals, machinery, electronics, transportation machinery, optical instruments, shipping, real estate, and warehousing.[3]

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[2] Porter, Michael E. *The Competitive Advantage of Nations*. New York, The Free Press, 1990. p. 52.

[3] Dodwell Marketing Consultants. *Industrial Groupings in Japan*. 8th Ed. 1988/89. Tokyo, Dodwell, 1988. p. 47ff.

The six major *keiretsu* organized into conglomerates use a variety of methods to tie their enterprises together. These include:

- crossholdings of shares,
- intra-group financing by a common bank,
- use of trading companies for marketing and organizing projects, and
- joint investments in new technologies.

The extent of stock crossholdings among the conglomerate *keiretsu* ranges from about 14 to 22 percent of total paid-up capital. These holdings of stock are rarely sold.[4] For the total Japanese economy, cross-shareholdings account for about 60 percent of all stock. The mutual share holdings reduce pressures on companies to increase short-term profits, protect against hostile takeovers, help bolster sagging stock prices, act as a substitute for holding companies which are prohibited by law, and sharpen the separation between management and ownership in such Japanese companies.

In terms of the commercialization of technology and product development, the share crossholdings ease the pressure for short-term results and enhance cooperation among member companies in different industries. Japanese business executives claim that such stable shareholdings allow company management to devote more attention to longer-term product development rather than to activities that might bolster the bottom line on the quarterly report. My observation is that the long-term development in this case applies primarily to the commercialization of technology or of research and development that is directly related to future commercial products. Japanese firms are not as active in basic research as their U.S. counterparts.

The main banks in the *keiretsu* not only hold shares of the member companies, but individual companies rely on them for as much as 30 percent of their loans.[5] Member companies also exchange information with the bank and maintain large deposits there. During credit crunches, the *keiretsu* family bank will tend to grant preferential access to loans for member firms and soften repayment terms when necessary.

The conglomerate *keiretsu* have deep pockets for financing R&D. They also compete with other *keiretsu* across many industries which means that they can ill afford to fall behind in an emerging technology. The firms in disparate product markets additionally allow their researchers to cross fertilize ideas with others within the industrial group. Mitsui, for example, has a joint venture called Mitsui

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[4] Since most companies carry these stocks at their historical value, many Japanese companies have balance sheets in which net worth is considered to be understated.

[5] Article 11 of Japan's Antimonopoly Law, however, limits holdings by financial companies to 5 percent of the total outstanding stock of any Japanese company.

Inter-business Research Institute that specializes in life sciences, future technology, ocean development, new communications media, and data processing.[6]

The massive size of the conglomerates has limited their ability to respond to certain market developments. Each has been slow in high-technology electronic markets compared with smaller specialty firms, but those firms entering the markets have enormous staying power.

In addition to the huge conglomerate *keiretsu*, numerous vertically integrated groups exist in Japan. These independent industrial groups resemble the corporate behemoths elsewhere in the industrialized world. Unlike the conglomerates, the groups usually are concentrated in one or a few industries and emphasize vertical buyer-supplier relationships, although ties with horizontal firms also are common.

There are no strict criteria for distinguishing a vertically integrated *keiretsu* from other large vertical groupings. One recognized authority identifies 39 groups in Japan whose sales exceeded one trillion yen in 1987. The list includes companies whose brand names garner world-wide recognition: Toyota, Nissan, Honda, Mazda, Sony, Mitsubishi Electric, Hitachi, Toshiba, NEC, Nippon Steel, Nippon Telegraph and Telephone, and Sharp.[7] Some of the vertical *keiretsu* also belong to conglomerates.

As with the conglomerate *keiretsu*, vertical *keiretsu* firms hold each other's shares, exchange information, and cooperate in new ventures. Since the relationship is vertical, however, the closest ties are between buyers and suppliers or between maker and distributor in the group. Under Toyota Motor, for example, stand 22 subsidiaries making auto parts or assembling sister products (such as looms) plus hundreds of other smaller suppliers.

Strong buyer-supplier links tend to pervade all Japanese businesses, but are the strongest within the *keiretsu*. The final manufacturer participates actively with the supplier in designing products, upgrading technology and manufacturing processes, and implementing quality control. The buyer usually is allowed to examine the supplier's books, and cost savings generally are passed on to the final manufacturer to be incorporated into the retail price of the product. The supplier is an integral link in the commercialization of new technology.

Akio Morita, the Chairman of Sony, once explained the advantage of the vertically integrated *keiretsu* in designing certain semiconductor chips. He said that designing and manufacturing a new chip is becoming so expensive that small companies virtually have to bet the company's financial future on each one. A large, integrated firm, like Sony, however, can afford to invest heavily in designing a new chip because it expects to recoup its investment not just in selling chips but in new consumer electronic products designed around that chip. The chip, itself, might eventually sell for less than $50, but the camcorder or VCR using that chip can sell for hundreds of dollars.

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[6] Dodwell Marketing Consultants. *Industrial Groupings in Japan*, 8th Edition, 1988/89. Tokyo, Dodwell, 1988. p. 59.

[7] Dodwell Consultants, *Industrial Groupings*, p. 141.

In automobile technology, companies such as Honda an Toyota have used their family of suppliers to generate the improvements needed for new generations of cars. Given the high reliance on outside suppliers for parts, Japanese automakers have pushed much of the task of incorporating new technology down to supplier firms. Rather than viewing procurement as a clerical process, Japanese buyers see procurement as a key strategic function of the firm. In general, they do not ask suppliers to respond to advertised specifications, but cooperate with them to improve their component parts and to reduce costs.[8]

Hence, the *keiretsu* organization assists member firms to commercialize and improve on products in diverse ways. It provides financial and marketing support. It provides a venue to exchange ideas and to cooperate in joint research projects within a family group. It provides a stable market for production, although *keiretsu* firms often buy from outside suppliers as well. But most importantly, it provides a long-term relationship in which manufacturers can push part of the burden of commercializing new technology down to their suppliers.

International Trade Environment

The discussion of trade in the commercialization of technology is usually couched in terms of the degree of protection from imports and flows of high-technology products. Much has already been written and said about these topics. There is little doubt that Japan has imported much technology from abroad—and continues to do so. There also is little doubt that a prominent tool in the kit used by Japan's government in its industrial policy is the protection of infant industries. The number of such protected industries, however, is diminishing rapidly, and U.S. pressures for market opening is gaining access for U.S. exports of satellites and other industries still developing in Japan. Those American firms who have made the commitment to sell in the Japanese market are doing very well indeed. Not only are they making profits, but the same competitive forces that drive Japanese companies are driving their subsidiaries or partners there. They are using their Japanese operation to gather information, develop new technology and products, and to learn new process technology.

For Japanese companies, international trade plays a further important role. Most firms view their potential market as the world, either directly or through a final manufacturer. World markets serve as a source of ideas for product development, as a standard by which productivity can be measured, and an outlet to absorb production from the ever growing manufacturing capacity at home.

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[8] Smitka, Michael J. Business-Business Relations: Auto Parts Sourcing in Japan. In U.S. Congress, Joint Economic Committee, *Japan's Economic Challenge*, S. Print No. 101-121, 101st Congress, 2d Session. Washington, U.S. Government Printing Office, 1990. p. 64ff.

Japan's manufacturers definitely do not suffer from the not-invented-here syndrome. They scour the world for information and ideas. Their competitive benchmarking of measures of productivity, efficiency, and quality control, moreover, tend to be world standards and not just local ones. Goals of market share now extend to foreign markets. Japanese companies battle each other as intensively in the United States and Europe as they do at home.

CONCLUSION

In conclusion, the Japanese business environment helps firms to commercialize new technology in three major ways. First, Japan's macroeconomic environment is conducive to long-term development. High economic growth combined with relatively low rates of interest have helped firms make the investments needed to adopt new technology and to commercialize new products to protect market share.

Second, the business environment threatens them with extinction if they do not keep up. Competition within Japan, particularly among the *keiretsu* groups, is so intense, that any company losing market share over an extended period of time will soon be out of that line of business.

Third, the business environment provides a structure that lessens the risks of failure in commercialization efforts. The family groups with cross shareholdings of stock and a bank to shore up the financial supports allow companies to take a longer term view of product development.

Mr. VALENTINE. Thank you, sir.

Mr. Mendelowitz.

Mr. MENDELOWITZ. Thank you, Mr. Chairman, and, with your permission, I'll submit my full statement for the record and read a shortened statement.

I'm pleased to be here today to discuss some of the factors that contribute to the success of Japanese firms in adapting new technologies to commercial applications. The ability to be first to bring new products to market, to commercialize technology, is crucial for industrial competitiveness, and some analysts fear that American business is simply not matching the ability of Japanese business to commercialize new technology and that this difference portends serious problems for the U.S. economy.

In view of Japan's economic successes, it is natural to examine how this was achieved. What did the Japanese government and businesses do that was critical to achieving this success? It is also reasonable to question whether there are aspects of government policy or business strategies or the structure of Japanese industry that would improve the ability of U.S. firms to commercialize technology.

Factors affecting the commercialization of technology by Japanese firms have to be viewed at several different levels. First, macro-economic policy—the monetary and fiscal policies of the government—sets the stage for commerce, and Japan's macro-economic policies have favored growth and, implicitly, the introduction of new technologies. Second, the goals, policies, and management systems of businesses themselves are key elements in economic success, and Japanese businesses are formidable competitors. Competition among Japanese manufacturers, for instance, is an important force that compels them to push for rapid commercialization of technology. And, finally, government policies directed at particular aspects of the economy or particular industries affect the ability of firms to commercialize technologies.

While I discuss the strategies at the three different levels, it is important to bear in mind that these components are not separate, nor do they operate in isolation. The components of success are inherently interrelated, and the likelihood of success is greatly enhanced by doing everything right.

Macro-economic policy plays a central role in determining the economic health of a nation. For businesses considering commercialization of new technologies, the cost of capital is a critical variable affected by macro-economic policy. The cost of capital dictates how a business views investment that is expected to yield a profit some time in the future. This applies to investment in physical assets, such as new equipment, as well as investment in research and development.

The advantages that lower capital costs provided to manufacturers are varied but can be summed up by pointing to one key implication. A firm with a lower cost of capital can afford to be more patient and have a longer planning horizon than a firm facing higher costs. A macro-economic policy that leads to lower interest rates and lower capital costs can encourage a firm to adopt a long-time horizon, and, with a longer planning horizon, a business can more easily undertake investments that have long pay-back periods, such as investment in research and development to commercialize new technology. According to a number of studies, Japanese firms have faced a substantially lower cost of capital than have U.S. firms.

Three characteristics of Japanese industry are also important to understanding its success. Taken together, they have provided an atmosphere that facilitates innovation.

First, much of Japanese industry is characterized by fierce horizontal competition. Almost all industries in which Japan has achieved particular international success contain at least several domestic rivals. Automobiles, consumer electronics, semiconductors, fax machines, and machine tools are just several examples. Rivalry forces firms toward automation, higher technology, and new products, and, for many industries, leadership position shifts frequently among competitors. One observer noted that Japanese firms accustomed to this environment often find competing with foreign rivals a relief.

Second, one aspect of Japanese business that has been critical to their ability to innovate is the structure and management of many Japanese companies. Japanese firms were first to adopt on a broad scale the total quality management model propounded by American experts such as W. Edwards Deming and Dr. Joseph Juran. In this approach, satisfying the customer's needs and wants is the key to gaining success in the market. One of the ways that this happens is through the reduction in cycle time required for the introduction of new products.

Relatively short cycle times provide increasing opportunities for introducing the latest technology into the marketplace. For example, a comparison of the U.S. and Japanese auto makers found that the Japanese brought out new products from the conceptual stage to market introduction in about two-thirds the time of American producers, and actual product cycles can differ by a greater amount. It is not unusual to find cars in the United States and Europe with a 10-year model life, whereas many Japanese models change every four to five years.

Finally, ownership ties among Japanese businesses can facilitate commercialization through reducing risk and fostering exchange of information. These ties can be both vertical and conglomerate in nature, and even among firms not part of these formal structures, or keiretsu, there are often strong, continuing buyer-seller relationships.

Just as Japan's macro-economic policies have aided commercialization through a relatively low and stable cost of capital, Japan's government has also carried out a variety of policies directed at specific industries or technologies. Since about 1970, industrial policy in Japan has reflected the conviction that Japan's international competitiveness is linked to success in high technology industries. Support of industries such as computers, electrical machinery, precision instruments, and robotics was carried out during the seventies and eighties using a variety of tools. One example is worth briefly outlining, the case of robotics.

Robotics were introduced in Japan for the first time in 1967. The industry developed at first with little or no government assistance. However, in the late 1970's, the government officially recognized the industrial robot as a means of boosting productivity and improving product quality. As a means of expanding the demand for robots and thus reducing the risk to firms engaged in bringing this technology to the marketplace, the government established in 1980 the Japan Robot Leasing Company. The Japan Robot Leasing Company has been the recipient of low-interest loans that have enabled it to lease robots to small and medium sized firms, turning a capital cost for these firms into an operating cost. In addition, the industry received a special depreciation allowance and MITI support for research and development. In 1991, due to a combination of management and economic factors as well as the government support, Japanese producers dominate the world market for robotics.

The Japanese government's broad role in influencing industrial and technological development continues to evolve. The role of MITI, the government agency traditionally at the center of Japan's industrial policy, has shifted from forcing the direction of commercialization to supporting more fundamental R&D with broader applicability. MITI's activities, such as support of research and development consortia, government labs, and publication of scientific and technological agendas for the future, may serve primarily to signal the country's technological and commercial future and thus reduce the risk to particular firms of undertaking certain research and development efforts.

Japanese success in commercializing new technology has occurred in a historical context, with a number of factors working together. At different times, the public and private strategies that led to that success have varied in importance. The involvement of the government in the structure of industry is less important today than it was 30 years ago. The strategies, goals, and management systems of businesses are much more important contributors than they had been earlier.

Nevertheless, there are three areas which are worth examining closely to see what implications they may hold for U.S. policy. First, it is clear that the macro-economic policy of a government sets the context within which other government and private strategies succeed or fail. In Japan, the macro-economic policies have contributed to a lower cost of capital than in the United States, enabling Japanese businesses to have a more patient planning horizon.

Second, while we pay much attention to the role of government in the Japanese success story, it would be a mistake to overlook the importance of Japanese business. Those businesses not only have the advantages that were created by lower capital costs, they also have been strong competitors. Japanese firms have been leaders in implementing management systems that are driven by the need to satisfy customers. This has meant significantly shorter product development cycles than are generally seen in U.S. firms, enhancing the likelihood that they would be first to commercialize new technologies important to customers. The nature of business relationships in Japan, most visible in the keiretsu, also contribute to faster introduction of new technologies. Stable, long-term supplier-customer relationships among firms enable them to move more quickly and in a more coordinated manner to bring emerging technologies to market than might be possible with business relationships not built on the shared interests of a long-term relationship.

Finally, government programs have been important, but the government's role has not been static. Compared with the policies that were in place 30 years ago, Japanese industrial policy today is not as forceful. It remains important, however, as a signaler of the direction of future technological developments in Japan and as a sponsor of longer-range, riskier research and development projects not as attractive to industry.

If we are to draw any lessons from this brief overview, it is that there is no single key to success. Success starts with well managed firms focused on meeting the needs of their customers. While government alone cannot bring about industrial success, its policies can reinforce or hamper the efforts of the private sector. Macroeconomic policies that lower the cost of capital can reinforce the efforts of a well managed firm just as macro-economic policies that make the cost of capital too high can frustrate the efforts of even the best managed firms. A similar analysis can be made for a whole host of government activities, including tax policy, government-supported research and development spending, defense procurement, and education.

It is clear that while the United States does not have an industrial policy, the Federal Government does have an array of programs and policies that affect the competitiveness of U.S. industry, including the rate at which new technology is commercialized. Some of the Government's action promote competitiveness, and others retard it. There is no consistency to the Government's influence on the competitiveness of U.S. industry. This lack of consistency was of less significance when U.S. industry was the unchallenged world leader. However, U.S. industry now faces formidable foreign competitors. Our response must recognize the extent to which actions of the public and private sectors are interrelated and how important it is that we strive to do everything right.

Thank you.

[The prepared statement of Mr. Mendelowitz follows:]

United States General Accounting Office

GAO

Testimony

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Commercialization of Technology by Japanese Companies

Statement of

Allan I. Mendelowitz, Director
International Trade, Energy, and Finance Issues
National Security and International Affairs Division

Before the

Subcommittee on Technology and Competitiveness
Committee on Science, Space, and Technology
House of Representatives

Mr. Chairman and members of the Committee:

We are pleased to be here today to discuss some of the factors that contribute to the success of Japanese firms in adapting new technologies to commercial applications. The ability to be the first to bring new products to market, to "commercialize" technology, is crucial for industrial competitiveness. And, some analysts fear that American business is simply not matching the ability of Japanese business to commercialize new technology, and that this difference portends serious problems for the U.S. economy.

The growth of the Japanese economy has been one of the most impressive stories of the post-War era. During the 1960s and 1970s, that economy's growth rate was frequently in the double digits. In the 1980s, the Japanese economy grew at an annual rate of 4.1 percent, compared with a 2.8 percent average for the United States.

Along with the overall growth of the economy, Japanese businesses developed into world-class competitors. Once known primarily as manufacturers of low-quality items, Japanese firms in many industries now manufacture products that define quality standards for the world. In some industries, most notably consumer electronics, Japanese firms are the innovators, the first to introduce new commercial applications of technological developments.

We are not in a position to say whether American business in general is losing this competition. U.S. firms continue to maintain a strong leadership position in certain key industries and associated technologies, such as aircraft and pharmaceuticals. But Japanese firms dominate other important industries, such as consumer electronics, certain types of office equipment, and robotics. And several recent studies by researchers in and out of government have reported significant strides by the Japanese in a number of advanced technologies.

In view of Japan's economic successes it's natural to examine how this was achieved. What did the Japanese government and businesses do that was critical to achieving this success? It is also reasonable to question whether there are aspects of government policy or business strategies, or the structure of Japanese industry, that would improve the ability of U.S. firms to commercialize technology?

Factors affecting the commercialization of technology by Japanese firms have to be viewed at several different levels. First, macroeconomic policy--the monetary and fiscal policies of the government--sets the stage for commerce, and Japan's macroeconomic policies have favored growth and, implicitly, the introduction of technologies. Second, the goals, policies and management systems of businesses themselves are key elements in economic success, and Japanese businesses are formidable competitors. Competition among Japanese manufacturers, for instance, is an important force that compels them to push for rapid commercialization of technology. Finally, government policies directed at particular aspects of the economy or particular industries affect the ability of firms to commercialize technologies.

While I will discuss the strategies at these three different levels, it is important to bear in mind that these components are not separate, nor do they operate in isolation. The components of success are inherently interrelated, and the likelihood of success is greatly enhanced by doing everything right. For example, the success or failure of a firm's efforts can depend critically on what the government does, such as pursuing favorable macroeconomic conditions, especially lower interest rates. In addition, an examination of Japanese government policy across time shows that the strategies that led to this success have varied in response to changes in the international and domestic economies; there has not been one strategy. Particularly with respect to industrial policy, the Japanese story is one of flexibility.

MACROECONOMIC POLICIES SET THE STAGE FOR COMMERCIALIZATION

Macroeconomic policy plays a central role in determining the economic health of a nation. For businesses considering commercialization of new technologies, the cost of capital is a critical variable affected by macroeconomic policy. The cost of capital dictates how a business views investment that is expected to yield a profit sometime in the future. This applies to investment in physical assets such as new equipment, as well as investment in research and development.

The advantages that lower capital costs provide to manufacturers are varied, but can be summed up by pointing to one key implication. A firm with a lower cost of capital can afford to be more patient and have a longer planning horizon than a firm facing higher costs. A macroeconomic policy that leads to lower interest rates and lower capital costs can encourage a firm to adopt a long time horizon. And, with a longer planning horizon, a business can more easily undertake investments that have long payback periods, such as investment in research and development to commercialize new technology.

According to a number of studies, Japanese firms have faced a substantially lower cost of capital than have U.S. firms. This is due largely to differences in national savings rates. These differences reflect both individual savings patterns and government borrowing and are due in part to higher U.S. outlays for social infrastructure and defense. Other determinants of the cost of capital to firms include differences in the tax system facing corporations, and various aspects of firm structure and behavior.

Measuring the cost of capital across countries is not a straightforward exercise, due to the variety of factors involved. But studies have revealed substantial differences in the cost of capital for Japanese as compared to U.S. firms in the 1970s and early 1980s. These differences, while they have likely narrowed in recent years due to partly integrated world capital markets and other factors, are still significant.

JAPANESE INDUSTRIAL STRUCTURE AND BUSINESS BEHAVIOR HAVE FACILITATED COMMERCIALIZATION

Three characteristics of Japanese industry are important to understanding its success. Taken together, they have provided an atmosphere that facilitates innovation.

First, much of Japanese industry is characterized by fierce horizontal competition. Almost all industries in which Japan has achieved particular international success contain at least several domestic rivals. Automobiles, consumer electronics, semiconductors, fax machines, and machine tools are just several examples. Rivalry forces firms toward automation, higher technology, and new products, and for many industries, leadership position shifts frequently among competitors. One observer noted that Japanese firms accustomed to this environment often find competing with foreign rivals a relief.

Second, one aspect of Japanese business that has been critical to their ability to innovate is the structure and management of many Japanese firms. For example, Japanese firms were first to adopt on a broad scale the total quality management model propounded by American experts such as W. Edwards Deming and Joseph Juran.

In this approach, satisfying the customer's needs and wants is the key to gaining success in the market. One of the ways that this happens is through the reduction in cycle time required for the introduction of new products. The best-managed Japanese firms, including many of those that have succeeded in American markets, have emphasized a relentless pace for the introduction of new products. This results in part from superior coordination of design and manufacturing, such that information is shared quickly across various activities of the firm.

These relatively short cycle times provide increasing opportunities for introducing the latest technologies into the marketplace. For example, a comparison of U.S. and Japanese automakers found that the Japanese brought new products from the conceptual stage to market introduction in about two-thirds the time of American producers. And actual product cycles can differ by a greater amount. It is not unusual to find cars in the United States and Europe with a 10 year model life, whereas many Japanese models change every 4 to 5 years.

There are, of course, examples of American firms that have commercialized new technologies quickly and successfully. Motorola was the first to market a compact cellular phone, and is now the world leader in that market. And its pagers, supplied to Nippon Telephone and Telegraph, were introduced in 1982 and now claim a major share of that market. Similarly, Xerox, which experienced substantial loss in market share during the 1970s and early 1980s, has reversed that trend through increasing attention to quality, reducing the number of suppliers that it deals with, and equipping their products with the features customers want.

Finally, ownership ties among Japanese businesses can facilitate commercialization through reducing risk and fostering the exchange of information. These ties can be both vertical and conglomerate in nature. And even among firms not part of these formal structures, or keiretsu, there are often strong, continuing buyer-seller relationships.

These vertical relationships are not necessarily permanent. But their relatively long term nature, particularly by U.S. standards, have an important implication for commercialization of technology. They can facilitate joint development of new products, including the transfer of technology, between parts suppliers and the manufacturers of final products. Because the firms have a long term relationship, it is in each firm's self interest to cooperate and invest in product development, increasing the speed of commercialization.

Auto parts sourcing provides an interesting example. Japanese auto makers have each developed a network of a few hundred suppliers of components, generally avoiding becoming vertically integrated producers of auto parts themselves. Unlike U.S. parts suppliers, these firms play a major role in product development. This provides an incentive to invest in specialized facilities and develop a close working relationship with the auto producer. If their performance and rate of quality improvement doesn't measure up, the automaker might step in with loans or technical assistance, or as a last resort replace the supplier. This combination of commitment and competition has contributed substantially to the success of the Japanese auto industry in commercializing technologies.

THE JAPANESE GOVERNMENT'S INDUSTRIAL POLICY HAS BEEN VARIED AND FLEXIBLE

As Japan's macroeconomic policies have aided commercialization through a relatively low and stable cost of capital, Japan's government has carried out a variety of policies directed at specific industries or technologies. Through the 1960s, Japan's postwar economic strategy focused on rebuilding basic industries and catching up with other industrialized countries. The government's role during that period has been described as fairly heavy-handed, directing scarce capital and resources into selected sectors, imposing limits on foreign entry, and providing export assistance to selected industries. The targeted industrial policy actions enhanced the effects of macroeconomic policies that provided artificially low interest rates and exchange rates that favored exports.

The Japanese steel and shipbuilding industries, for example, evolved largely in conjunction with specific plans for expansion and very favorable loan programs. These two industries, I might add, are among those that subsequently received government assistance in scaling back operations as world demand conditions changed.

It is also interesting to note that Japanese industry was not always compliant in this era of strong direction. Consolidation was an early--and recurrent--theme in the government's plan for the automobile industry, which the industry consistently rejected. And Japan's targeting of specific industries has not always been correlated with immediate success. For example, in the case of civilian aircraft, government assistance has been substantial; yet the industry has not thus far evolved into a world class competitor.

Since about 1970, industrial policy in Japan has reflected the conviction that Japan's international competitiveness is linked to success in high technology industries. Support of industries such as computers, electrical machinery, precision instruments and robotics was carried out during the seventies and eighties using a variety of tools.

Two examples are worth outlining briefly. The first is robotics. Robots were introduced in Japan in 1967. The industry developed, at first, with little or no government assistance. In the late 1970s, the government officially recognized the industrial robot as a means of boosting productivity, and improving product quality. As a means of expanding the demand for robots, and thus reducing the risk to firms engaged in bringing this technology to the marketplace, the government established in 1980 the Japan Robot Leasing Company. The Japan Robot Leasing Company has been the recipient of low interest loans that have enabled it to lease robots to small and medium sized firms, turning a capital cost for those firms into an operating cost. In addition, the industry received a special depreciation allowance and MITI support for research and development. In 1991, due to a combination of management and economic factors as well as the government support, Japanese producers dominate the world market for robotics.

A second example is the government's role in the semiconductor industry. In the infancy of Japan's semiconductor industry, the government's primary role was to provide trade protection. During the 1970s, the importance of the semiconductor industry became clear to Japanese government and industry, and the government's role in the industry grew. Beginning around 1973, MITI provided substantial research and development support for individual firms and for consortia. The Very Large Scale Integration Project was begun in 1976, with the goal of developing large scale integrated circuits. Several firm participated, with the help of success-conditional government loans. The success of this effort played an important role in Japan's move to a leadership position in the world semiconductor market.

The Japanese government's broad role in influencing Japanese industrial and technological development continues to evolve. The role of MITI, the government agency traditionally at the center of Japan's industrial policy, has shifted from forcing the direction of commercialization to supporting more fundamental R&D with broader applicability. MITI's activities, such as support of research and development consortia and government labs, and publication of scientific and technological agendas for the future, may serve primarily to signal the country's technological and commercial future, and thus reduce the risk to particular firms of undertaking certain research and development efforts.

As Japan has moved to the frontier in many areas of applied science, there is much interest in its future role in pushing out that frontier through engaging in basic research. While the proportion of GNP spent on research and development is similar for Japan and the United States, only a fraction of Japan's spending is in basic research. And while there are several areas where Japan's basic research is considered world class, most of the country's research and development is undertaken by industry, which focuses understandably on research with foreseeable commercial applications. The Japanese government has announced its intention to substantially improve its basic research capabilities and output.

IMPLICATIONS

Japanese success in commercializing new technology has occurred in a historical context, with a number of factors working together. At different times, the public and private strategies that led to that success have varied in importance. The involvement of the government in the structure of industry is less important today than it was 30 years ago, for instance. The strategies, goals, and management systems of businesses are much more important contributors today than they had been earlier.

Nevertheless, there are three areas which are worth examining closely to see what implications they may hold for U.S. policy. First, it is clear that the macroeconomic policies of a government set the context within which other government and private strategies can succeed or fail. In Japan, the macroeconomic policies have contributed to a lower cost of capital than in the United States, enabling Japanese businesses to have a more patient planning horizon.

Second, while we pay much attention to the role of government in the Japanese success story, it would be a mistake to overlook the importance of Japanese business. Those businesses not only had the advantages that were created by lower capital costs; they also have been strong competitors. Japanese firms have been leaders in implementing management systems that are driven by the need to satisfy customers. This has meant significantly shorter product development cycles than are generally seen in U.S. firms, enhancing the likelihood that they would be first to commercialize new technologies important to consumers. The nature of business relationships in Japan, most visible in the keiretsu, also contribute to faster introduction of new technologies. Stable, long term supplier-customer relationships among firms enable them to move more quickly and in a more coordinated manner to bring emerging technologies to market than might be possible with business relationships not built on the shared interests of a long term relationship.

Finally, government programs have been important, but the government's role has not been static. Compared with the policies that were in place thirty years ago, Japanese industrial policy today is not as forceful. It remains important, however, as a signaller of the direction of future technological development in Japan, and as a sponsor of longer range, riskier research and development projects not as attractive to industry.

If we are to draw any lesson from this brief overview it is that there is no single key to success. Success starts with well managed firms focusing on meeting the needs of their customers. While government alone cannot bring about industrial success, its policies can reinforce or hamper the efforts of the private sector. Macroeconomic policies that lower the cost of capital can reinforce the efforts of a well managed company, just as macroeconomic policies that make the cost of capital too high can frustrate the efforts of even the best managed firms. A similar analysis can be made for a whole host of government activities, including tax policy, government supported research and development spending, defense procurement, and education.

It is clear that while the United States does not have an industrial policy, the federal government does have an array of programs and policies that affect the competitiveness of U.S. industry, including the rate at which new technology is commercialized. Some of the government's actions promote competitiveness and others retard it. There is no consistency to the government's influence on the competitiveness of U.S. industry. This lack of consistency was of less significance when U.S. industry was the unchallenged world leader. However, U.S. industry now faces formidable foreign competitors. Our response must recognize the extent to which actions of the public and private sectors are interrelated and how important it is that we strive to do everything right.

Mr. **Valentine**. Thank you, sir.

Mr. Cheney.

Mr. **Cheney**. Mr. Chairman and members of the subcommittee, thank you for the opportunity to testify on this important subject.

As this hearing recognizes, America's weakness in technology vis-a-vis Japan is clearly not in its ability to discover new technologies but in its ability to get technologies quickly to the market and products that meet the demands of commercial markets. Japan is clearly a country we can learn from in the commercialization of technology.

I will briefly summarize my remarks. In addition to my written statement, I would like to submit a copy of our recent report on Japanese technology policy for the record.

In my testimony today, I will discuss some of the reasons for Japan's success and the directions in which we need to move to match their performance. My remarks will focus on Government technology policy. It should be remembered, however, the private sector clearly bears the primary responsibility for commercializing technology, and other policies, such as economic and trade policy, which the other witnesses have already addressed, are also critical. My testimony really complements theirs and doesn't substitute for their testimony.

My basic point is simple. Japan is better at commercializing technology because its science and technology enterprise was designed—and has continually evolved—to excel in it. Japan's science and technology apparatus was set up to promote economic growth. Since the 1870's, Japan's national mission has been to catch up and pass the West. Japanese science and technology policies are integrated with Japan's policies to promote industrial growth.

By contrast, our science and technology policies were largely established after World War II when we had unquestioned economic supremacy. Our major concern was our military rivalry with the Soviet Union. Our science and technology policies were set up primarily to meet national security needs. So it shouldn't really be surprising that Japan's science and technology system is more efficient at producing commercial technologies than ours because ours still relies, on a large extent, to somewhat serendipitous spin-offs.

Another point to mention is that Japan began this technological race at an extreme disadvantage. Japan had less money, had fewer scientists and engineers, and fewer research facilities. Japan couldn't really compete with the West in developing technology. Instead, they imported a lot of technology from the West, and they shared it among Japanese companies. The companies cooperated rather than competed in technology. So then the focus of their competition shifted from being on developing technology to really being in commercializing it. Since they couldn't compete in developing the technology, they instead raced both among each other and in competing with the rest of the world in getting the technology to the market faster and producing products more efficiently. In this way, Japan has really excelled by making a virtue out of something it developed from necessity.

What does Japan specifically do to commercialize technology? First, to turn research and development into commercial products, it is critical to have close contacts between R&D activities and the commercial marketplace. Companies have found that when their R&D people work with their marketing people they are more likely to generate marketable innovations, which is somewhat common sense but a lot of companies have taken a long time to realize that.

Exchange of people is the surest way of getting ideas from one organization to another. These things are true both within companies as well as between institutions. So to promote rapid commercialization of technology, one wants Government-funded R&D to involve industry in the design and conduct of the R&D, and one also wants to really stimulate R&D conducted by the companies, because that is more likely to produce commercial benefits than just Government R&D funding.

If one examines Japan's conduct of R&D, one finds that it does both. First, government R&D is oriented towards supporting commercial technologies and is conducted with industry participation. The Japanese government spends much less than the United States on defense, space, and health R&D and much more on R&D to support industrial development. Industry is also much more involved in the design and conduct of government-funded R&D in Japan than in the United States.

For example, many of Japan's national research laboratories were established specifically with the purpose of assisting industry. By contrast, in the United States, really only the National Institutes of Standards and Technology has a primary mission of supporting industry.

Industry in Japan participates in the setting of R&D priorities and establishing R&D projects. The government maintains close and continual contact with industry and uses industry associations and advisory committees with extensive industrial representation to review and endorse technology projects and policies.

Second, government policies encourage private R&D. The private sector in Japan now conducts more R&D as a percentage of GNP than in any other country. There are several mechanisms by which the government promotes this. One mechanism is that much government funding of R&D goes through cooperative industrial research. This accelerates the commercialization of technology in two ways. First, the government money leverages private R&D, and, second, when companies share technology, they have to compete by getting the technology to the market more quickly.

Japan also has several programs to lower the cost of funds for R&D. They have a basic R&D tax credit that is generally similar to ours except that it is permanent and thus more effective because companies can factor it into their long-term budgets. There are additional tax credits for the cost of acquiring facilities for research and development in fundamental technologies and for R&D by small and medium sized enterprises. Cooperative research associations, analogous to R&D consortia such as Sematech or MCC in the United States, get additional favorable tax treatment, including rapid depreciation schedules on their capital equipment.

In addition, there are several other programs to aid in the financing of key technologies. One is the government-financed Key Technology Center, an organization with no U.S. counterpart, which provides capital investment for cooperative research and interest-free loans for high-risk technologies. The Japan Development

Bank also provides funds at attractive interest rates for the commercialization of important industrial technologies and for the construction of research facilities.

MITI also has influence over strategic trade policy, industry structure, and industry's regulatory environment, and uses these levers to promote technology development. The result is an environment in which it is easier for companies to make long-term investments.

While Japan's system of promoting technology is, in fact, a system, with many interlinked elements, which we cannot easily copy, there are many improvements which we can make within the framework of the U.S. system. These recommendations that I will discuss are not just my own but those of the Council on Competitiveness and are contained in our recently released study which the chairman referred to earlier, *Gaining New Ground: Technology Priorities for America's Future.*

First, we need to strengthen the programs that do contribute to commercial technology in the United States. We believe that the National Institutes of Standards and Technology—that is the only Federal laboratory with a primary mission of supporting industry—needs to be strengthened. The advanced technology program is a good example of a program focused on industrial needs that has extensive industrial participation.

Similarly, NIST's manufacturing centers deserve strong support. The National Institutes of Health, the National Science Foundation, and the Defense Advanced Research Projects Agency all have demonstrated their ability to contribute to commercial technologies, partly because they support universities, which play a vital role in education, basic research, and is an area where we are much stronger than Japan is, and universities transfer technology and they send people to industry. All of these institutions, however, can still benefit from closer links to industry.

Second, programs that are not contributing to the effect of commercialization of technology should be reevaluated. Many of the over 700 federal laboratories are in this category. Many of these laboratories are isolated from industry, and industry feels that it gets little benefit from their R&D. In some cases, the best policy may be to consolidate or close some of the laboratories. In other cases, the goal should be to involve industry in the conception, design, and conduct of their R&D programs. It is not just a matter of improving technology transfer but of really changing the lab's culture, mission, and relationships with industry.

Finally, we need to create an economic and regulatory environment that encourages the private sector to invest in technology. Lowering the cost of capital for technology development is critical. A first step is to make the research and experimentation—R&E—tax credit permanent and make sure that it applies to process R&D and R&D devoted to improving products.

Some additional mechanisms like those the Japanese have may also be worth exploring. In addition, making the regulatory environment better support technological innovation will also enhance the commercialization of technology. We believe that these recommendations will help make U.S. policies better support the commercialization of technology.

Thank you very much for the opportunity to contribute to your hearing, and I will, at the appropriate time, be happy to respond to any questions.

[The prepared statement of Mr. Cheney follows:]

Council on Competitiveness

STATEMENT OF DAVID W. CHENEY
Senior Associate
Council on Competitiveness

Before the

Subcommittee on Technology and Competitiveness
Committee on Science, Space, and Technology
United States House of Representatives

April 30, 1991

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to discuss Japan's policies that lead to an advantage in commercializing technology.

This is a timely hearing on an important subject. America's weakness in technology vis a vis Japan is clearly not its ability to discover new technologies, but its ability to get technologies quickly to the market in products that meet the demands of commercial markets.

Our best companies are increasingly aware of the importance of benchmarking their competition. In each aspect of their business, they are looking around the world to find out who does it best, and then finding ways to match their performance.

As a nation, we need to take a similar approach in public policy. We have to find the countries that have the most effective policies, learn how they do it, and find ways to match or surpass their performance. It is clear that Japan, along with Germany, are the countries to match in the commercialization of technology.

In my testimony today I will discuss some of the reasons for Japan's success, and the direction in which we need to move to match their performance. My remarks will focus on government technology policy. It should be remembered that these are not a complete prescription for success. The private sector clearly bears the primary responsibility for commercializing technology, and other policies, such as economic and trade policy are also critical.

My basic point is a simple one: Japan is better at commercializing technology because its science and technology enterprise was designed to excel in it. Our science and technology enterprise is not good at commercializing technology because it has never been a primary goal like enhancing national security or fighting cancer. Our system produces commercial technologies through "spinoffs" and "technology transfer" rather than by design.

We must reset our technolcgy priorities to greatly improve the commercialization of technology if we are to stay at the forefront of high technology. In the first analysis, to do this does not require more money, but new priorities.

Commercializing Technology

First, I would like to make some basic points about commercializing technology. To turn research and development (R&D) into commercial products, it is critical to have close contacts between R&D activities and the commercial marketplace. Companies have found that when their R&D people work with their marketing people, they are more likely to generate marketable innovations. The exchange of people is the surest way of getting ideas from one organization to another. This is true both within companies as well as between institutions.

Some types of R&D are more likely to provide benefits to commercial products than other types:

- R&D conducted by companies involved in the commercial marketplace is more likely to result in commercially successful innovations than R&D conducted by the government.

- Government-funded R&D in which industry participates and sets the direction is more likely to result in innovation than government R&D in which industry is not involved.

- R&D conducted in institutions, such as universities, where new people with new ideas enter and subsequently move to industry, is likely to provide greater benefits than R&D conducted in institutions where the researchers are isolated from industry and the turnover is low.

Public policies that encourage private sector R&D, and support R&D in institutions with close links to industry, are more likely to promote the commercialization of technology. On the other hand, R&D performed in institutions that have little contact with commercial markets, whether in government research laboratories or in companies that do not compete in the commercial markets, is less likely to result in commercially successful products.

Historical Roots of Japan's Success in Commercialization

To understand Japan's success in the commercialization of technology, it is important to understand why Japanese and U.S. technology policy evolved differently.

Japan's science and technology apparatus was set up to promote economic growth. Since the 1870s, Japan's national mission has been to "catch up and pass" the west. Before World War II this was characterized by the phrase "rich country, strong military".. Since World War II, it has been characterized by phrases such as "overtake Europe and America" and "high speed growth". Japanese science and technology policies are integrated with Japan's policies to promote industrial growth.

By contrast, our science and technology policies were largely established after World War II, when we had unquestioned economic supremacy. Our major concern was our military rivalry with the Soviet Union. Our science and technology policies were set up to meet national security needs and, later, to support other national missions such as health, space, and energy.

It should not be surprising that Japan's science and technology system, which produces economic benefits through intent honed by decades of experience, is more efficient at producing commercial technologies than ours, which relies to a large extent on serendipitous spinoffs.

A second point to mention is that Japan began this technological race at an extreme disadvantage. Japan had less money, fewer scientists and engineers, and fewer research facilities. Japan could not compete with the west in developing technology. Instead, they imported a great deal of technology from the west and shared it among Japanese companies. The companies cooperated rather than competed in technology. The focus of their competition, among themselves and eventually with the rest of the world, shifted to getting the technology to the market fasfer and producing products more efficiently. In this way, Japan has excelled by making a virtue out of a necessity.

Japan's technology development strategy is also selective. The United States spends more on research and development, employs more researchers, and publishes far more technical papers. But at the bottom line, Japan exports more high technology products because their R&D is targeted towards commercially important areas.

There are two basic features that contribute to Japan's excellence in commercializing technology. First, government research is oriented towards supporting commercial technologies and is conducted with industry participation. And second, government policies encourage private sector R&D.

Government R&D is Focused on Industrially Relevant Areas

As mentioned above, the Japanese government spends much less than the United States on defense, space, and health R&D, and much more on commercially relevant R&D. Although the U.S. government funds a greater total amount of R&D, Japanese government non-defense R&D spending as a percentage of GNP exceeds that of the United States, and much more Japanese government R&D supports industrial needs. According to the National Science Foundation, 4.8 percent of Japan's R&D is funded for the purpose of industrial development, compared to 0.2 percent for the United States.

The Japanese Ministry of International Trade and Industry (MITI), the ministry with a primary mission of promoting industrial development, has 13 percent of Japan's R&D budget. The United States' closest counterpart, the Department of Commerce, has less than 1 percent of the U.S. R&D budget.

There is also a difference in how the government R&D is conducted. Industry is much more involved in the design and conduct of government-funded R&D in Japan than in the United States. For example, many of Japan's national research laboratories were established with the purpose of assisting industry. Most notable among these are MITI's 16 National laboratories run by the Agency of Industrial Science and Technology. Industry participates in the research in the these laboratories and many of these laboratories are involved in cooperative industrial research programs. By contrast, in the United States, only the National Institute of Standards and Technology has a primary mission of supporting industry.

Equally important, industry in Japan participates in the setting of R&D priorities and establishing R&D projects. MITI maintains close and continual contact with industry, and uses industry associations and advisory committees to review and endorse technology projects and policies. Other ministries, such as Post and Telecommunications, Transportation, Health and Welfare, and Construction also maintain close contacts with the industries under their jurisdiction.

Japanese Government Policies Leverage Private Sector R&D.

The private sector in Japan conducts more R&D as a percentage of GNP than in any other country. Many government programs are designed to stimulate private sector R&D.

One mechanism is through government funding of cooperative industrial research. This accelerates the commercialization of technology in two ways. First, the government money leverages private R&D. And second, by bringing several companies to the same level of technology, they are encouraged to invest in technology development to get their products to the market ahead of their competitors. When companies share technology, they have to compete by getting the technologies to the market more quickly.

Japan also has several programs to lower the cost of funds for R&D. They have a basic R&D tax credit that is generally similar to ours except that it is permanent, and thus more effective because companies can factor it into their long-term budgets. There are additional tax credits for the cost of acquiring facilities for

R&D in fundamental technologies and for R&D by small and medium sized enterprise. Cooperative research associations, analogous to R&D consortia such as SEMATECH in the United States, get additional favorable tax treatment, including rapid depreciation schedules on their capital equipment.

There are also several other programs to aid in the financing of key technologies. One is the government-financed Key Technology Center, an organization with no U.S. counterpart, which provides capital investment for cooperative research and interest free loans for high risk technologies. The Japan Development Bank also provides funds at attractive interest rates for the commercialization of important industrial technologies and for the construction of research facilities.

MITI also has influence over strategic trade policy, industry structure, and industry's regulatory environment, and uses these levers to promote technology development. The result is an environment in which it is easier for companies to make long-term investments.

The Council has another major study underway on the Time Horizons of American Management, which is analyzing the factors that affect investment in the United States, Japan, and Germany. Results from that study will be forthcoming in a few months.

Recommendations

While there are many parts of Japan's system of promoting technology that we cannot easily copy, there are many improvements we can make within the framework of the U.S. system. The Council on Competitiveness recently released a major technology policy study, Gaining New Ground: Technology Priorities for America's Future. Some of the recommendations in that study are highly relevant to the topic of today's hearing.

A premise of the Council's recommendations is that the private sector has the primary role in improving the commercialization of technology. Individual companies need to match the best commercialization practices of their competitors, domestic or foreign. In addition, U.S. industry needs to develop new mechanisms of sharing the costs and risks of precompetitive technology development, which can encourage them to devote greater resources to product commercialization.

The government has an important supporting role. We need to strengthen the elements of American technology policy that provide the greatest benefits to commercial technologies, and we need to make the economic environment better support industrial R&D.

First, we need to strengthen the programs that do contribute to commercial technology. We believe that the National Institute of Standards and Technology (NIST), as the only Federal laboratory with a primary mission of supporting industry, needs to be strengthened. The Advanced Technology Program is a good example of a program focused on industrial needs that has extensive industrial participation. Similarly, NIST's manufacturing centers deserve strong support.

The National Institutes of Health, the National Science Foundation, and the Defense Advanced Research Projects Agency have all demonstrated their ability to contribute to commercial technologies. Nevertheless, they can still forge closer links with industry. Universities play a vital role in education and in basic research, but can also benefit from closer links to industry.

Second, programs that are not contributing to the effective commercialization of technology need to be reevaluated. Many of the over 700 federal laboratories are in this category. Many of these laboratories are isolated from industry, and industry feels that it gets little benefit from their R&D. While some still have valid missions, others may have outlived their original purpose. In some cases, the best policy may be to consolidate or close the laboratory. In other cases, the goal will be to involve industry in the conception, design, and conduct of their R&D programs. It is important to emphasize that for R&D programs at these laboratories to contribute to commercial technology, there needs to be an exchange of people with industry. Industry needs to be involved at the beginning of the R&D process, not just at the end.

Third, government procurement should better support the commercialization of technology. Reducing unnecessary barriers between defense and civilian technologies is one mechanism. Making the government a discriminating customer of technology is another.

And finally, we need to create an economic and regulatory environment that encourages the private sector to invest in technology. Lowering the cost of capital for technology development is critical. A first step is to make the research and experimentation (R&E) tax credit permanent. In addition, making the regulatory environment better support technological innovation will also enhance the commercialization of technology.

We believe these recommendations will help make U.S. policies better support the commercialization of technology. Thank you for the opportunity to contribute to your hearing. I would be please to respond to any question you may have.

Mr. **Valentine**. Thank you, sir.

The chair will recognize at this time the distinguished lady from Maryland, Mrs. Connie Morella, on a point of personal privilege.

Mrs. **Morella**. Thank you very much. I appreciate that, Mr. Chairman, and I would ask unanimous consent that my opening comments might be included in the record.

But I wanted to thank you, Mr. Chairman and the ranking member of the committee, for this very important hearing today on technological competitiveness and what we can do, and gaining new ground is really an advancement.

But the point of personal privilege was to indicate that among the very prominent witnesses testifying today is a gentleman who represents the area—or I represent the area in which Technology International, Incorporated, is located, and I am very proud of the fact that he is one of the people testifying today.

Mr. Bloom, it is a pleasure to have you here. We do have a high technology corridor, we do have NIST located there, and we have indicated that we are moving ahead in biotechnology and a lot of those areas that you will be alluding to today.

So welcome, Mr. Bloom, and thank you very much, Mr. Chairman, for that opportunity.

Mr. **Valentine**. Thank you.

Mr. Bloom, the chair recognizes you at this time, and that is calculated to give your testimony additional impetus.

Mr. **Bloom**. That also places an additional burden on me, Mr. Chairman.

Thank you very much for the privilege of joining this panel this morning, and my special thanks to Mrs. Morella. I have testified before Congress many times; this is the first time I have had the honor of having my own Congressional representative present.

This morning, I would like to augment my prepared remarks rather than summarizing them. Events change rapidly in this area, and it is sometimes very difficult to keep up with where we stand vis-a-vis Japan.

The theme of my prepared comments was that, while technology development is essential to achieving competitiveness in world markets, it is not the only ingredient of what is a very complicated matrix; my colleagues at this table have addressed some of the other issues that rank certainly as important as technology development itself, and I can say this as a technologist. I have been involved in R&D for many years and know that the technology by itself must be exploited by business and finance and all the other sectors of an economy.

Subsequent to the preparation of my statement, the Office of Science and Technology Policy of the White House issued its long awaited Critical Technologies List, and I believe you have already heard testimony about this in the past few days. It is a good list. I presented comments about a number of others, including the report of the Council on Competitiveness in my prepared testimony.

If the OSTP list—what I read about the list in the newspapers, the OSTP list, is accurate, then I see an anomaly, however. Most of the items on the OSTP list are generic, such as genetic engineering, or aeronautics. One, though, is not; that is the item, "High definition television display panels." This is not so much a technology as it is a high-tech product and, hence, constitutes an attempt to encourage entry, or maybe we should call it reentry, into development and manufacture of a specific piece of hardware.

By coincidence—I like to think maybe it was a little bit of prescience involved—I had used the case of HDTV in my prepared remarks to point out the problems entailed in trying to enter at a late point into the development of an advanced technology.

One of the points made by the charter for this hearing is that Japan has purchased substantially more technology from abroad, particularly from the U.S., than it has sold. This is taken as a sign of weakness in the Japanese R&D structure, and, again, I caution that things change and sometimes rapidly, and therefore, although history is important in watching for trends, one must also keep aware of the current situation.

In this particular case, the data cited for the deficit in Japanese technology trade are no longer valid. More recent figures published by MITI show that in the Japanese fiscal year 1989 the cost of technology exports rose to about $2.5 billion, an increase of 19 percent, while imports rose only 5.7 percent to a value that is almost exactly the same. The deficit now is only $5 million. So, you see, the deficit in Japanese technology trade has dropped from $500 million to $5 million in one year. In other words, I think we can say that, at least for the time being, until we see other figures in the future, Japan has achieved a rough balance in its technology trade.

At the same time, we should recognize that Japan continues to purchase large amounts of technology from abroad, particularly from the United States, but it also has become a significant supplier of technology, in this case particularly to less developed nations.

One of the themes that has drawn my attention over the past 15 years is that Japan's scientific capabilities, while seemingly weak compared to those of the U.S., and, in fact, are weak compared to the U.S., are growing, and this is another example of what I am trying to talk about, the dynamism of the situation. These capabilities are growing and may well become a force to be reckoned with.

One measure of this trend, not an exact one but an interesting one, can be found in comparative figures for citations to papers generated by Japanese scientists by other scientists in a particular field. There is an organization in Philadelphia called the Institute for Scientific Information that prepares statistics on this subject, and the latest figures are really quite revealing.

Japan is ranked fifteenth among advanced nations in the number of citations per published paper—I emphasize those three words—over the period 1981 to 1990. Switzerland and Sweden both lead the United States, which is in third place in this ranking of citations per paper.

However, if one examines the data for total number of scientific papers published or total number of citations, then the U.S. ranks first among all nations. The United Kingdom is second, and Japan is third. This indicates that Japan already is at the world class in the conduct of original scientific research, ranked—over-ranked only by the United States and Great Britain.

The publishers of this type of analysis indicate also that Japanese scientists publish a disproportionately large number of papers in the physical, chemical, and applied sciences, and papers in these categories typically are less cited than those in the biological sciences.

I believe a few additional comments are warranted about this kind of perspective also. First, it is obvious that just being prolific and even authoritative in science is hardly a guarantee of industrial competitiveness, and the best example lying before us is the United Kingdom, who you may recall ranked second in total number of scientific publications.

Another factor, in my opinion, is that the value of Japanese scientific research is quite understated by the citation analysis in that it does not take into account the many journals published in Japanese which are not included in the Philadelphia Institute's citation data base.

The third factor, and maybe the most important one for the purposes of this hearing, is that American scientists are just not reading the Japanese scientific literature to the extent that they should, even when it is published in English. Consequently, they often fail to cite research in Japan.

This last problem, I think, was addressed in fine manner by the Congress in years past, culminating in the passage of the Japanese Technical Literature Act of 1987. Unfortunately, neither the Congress nor the executive branch have seen fit to provide the resources necessary to implement the Act and thereby improve access by American scientists and engineers to the results of Japanese research.

As a consequence of this lack of attention, I think we will have to prepare ourselves for some surprises in the future as Japan begins to take its place as not only a marketer of high technology products but also as an innovator in science. One clue to this trend can be found in the fact that in the field of biology Japan is considered weak by most of the comparative lists or analyses that have been made, including the Council on Competitiveness analysis and the OSTP competitive technology list.

However, when you look at citations to the literature, you find that on occasion some Japanese papers are now being cited more than any other in the field of biology. Biology and related fields, such as biotechnology and medical research, are high on the Japanese list of priorities for advancement in the future, and the impact is beginning to be felt.

I have tried in these brief remarks to integrate science and technology into the broader concept of competitiveness and ask that you not try to consider technology in isolation in that sense.

Thank you very much for your attention.

[The prepared statement of Mr. Bloom follows:]

JAPANESE TECHNOLOGY POLICY AND ITS INTERNATIONAL CONSEQUENCES

Testimony before the Subcommittee on Technology
and Competitiveness of the House Science, Space,
and Technology Committee

April 30, 1991

Justin L. Bloom
President, Technology International, Inc.
11600 Georgetowne Court
Potomac, MD 20854
(301)983-8247

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Justin L. Bloom
Technology International, Inc.

I appreciate being given the privilege of testifying once again before that part of the Congress that has the greatest interest in science and technology and the capacity of the United States for conducting research and development to the nation's benefit.

The Congress and the American public continue to be bemused -- some would say distressed -- by the now commonly held belief that the U.S. has lost its lead over other countries in technical preeminence, and that this in turn has contributed to our loss of international markets and a decline in our competitiveness. Certainly technology is an important ingredient of industrial competitiveness but it is not the only one. If I could leave one thought with the members of the Subcommittee, it would be that scientific or technological superiority by themselves will not guarantee achieving either competitiveness or markets. Rather, we should be using a systems approach to studying our relative strengths and weaknesses in arriving at conclusions or decisions regarding where we wish to go and how we are to get there. By this I mean that the complex interrelationship of such factors as capital formation and interest rates, reduction of the Federal budget deficit, anti-trust laws, education and training of the workforce, government vs. private support of research and development, isolation of domestic markets from imports, and international technical cooperation must be examined as part of an equation in which technological strength is also a variable.

Unfortunately, in my opinion, we tend to throw up our hands in resignation at the thought of trying to change most of the variables in this equation. For example, little if anything is being done to alter the savings habits of the American public so that people spend less and save more, thereby increasing the financial capital available for investment and reducing interest rates correspondingly. Likewise, the problem of functional and real illiteracy in the labor force -- at a time when increasing demands are being placed on workers to perform more complicated tasks -- is a daunting one that will not be solved by Presidential entreaties. The variable that seems so easy to maximize is technological advantage, because it appears to be one that will be receptive to having relatively modest amounts of money thrown at it, is relatively easy to identify and measure, and can hardly be questioned as being worthwhile in itself.

The interrelationship of advances in technology with the many other important politico-economic issues facing the U.S. has been addressed in sober and thorough detail by a Congressional

Research Service task force headed by Dr. Dick Nanto in its report of February 2, 1990 (Japan-U.S. Economic Issues: Investment, Saving, Technology, and Attitudes). I suggest that anyone -- but most of all Members of Congress -- interested in a first-class, objective treatment of most of the concerns I have expressed should examine this document with care. I note, however, that the Nanto report does not examine the place of improving the U.S. educational system in the economic scheme of things. Likewise, Japan's Economic Challenge, a print of the Joint Economic Committee published in October 1990, places technology in the context of economics and trade, but fails to address the technical literacy issue except in briefest terms.

I believe that the Council on Competitiveness has covered the technological aspects of competitiveness in an exemplary manner and its report, Gaining New Ground: Technology Priorities for America's Future, should be required reading for anyone with an interest in this subject. There is little more that needs to be said in terms of the prescription it offers for this one aspect of competitiveness, but it treats other aspects of the problem somewhat more lightly. I recognize that one of the four major recommendations of the Council is devoted to economic rather than technical factors, but there is no mention of devoting efforts to improving the quality and literacy of the American workforce, for example.

Another publication of the Council concerns Japanese R&D specifically (Japanese Technology Policy: What's the Secret?). Since Mr. David Cheney, the author of this report, is present here and will testify, I will not say more about his report other than to compliment Mr. Cheney for producing a first-class contribution to understanding the Japanese R&D scene.

The Council on Competitiveness and an increasing number of other organizations, now including OSTP, are devoting themselves to preparing "critical technology lists" which usually compare how the U.S. stands in each defined technology with its international competitors. Although these lists are useful to a degree to technologists and serve to educate policymakers about the ramifications of technology, they may also be misleading. For one thing, there are so many lists now that we can find almost any technology being defined as "critical" if we look long enough. The Council itself identifies five major technical fields incorporating 23 subordinate fields which in turn contain 94 technical areas. There is something for everyone here. The U.S. is held to be strong or competitive in 61 of these areas and weak or losing badly in 33. If this comparison is correct, we could conclude that the U.S. is doing quite well but should not rest on its laurels. However, the temptation is to look for those technologies in which the U.S. is behind and then try to establish a catch-up mentality for recovering from the perceived disadvantage. Invariably, this involves requests for government financial support. I am a strong believer in a greater involvement by the U.S. Government in supporting industrial R&D when enabling technologies of the kind identified by the Council on Competitiveness are involved. I fear, however, that the Government -- like parts of the private sector -- does not have the stomach for engaging in R&D programs in which payoffs in the form of competitive commercial products cannot be assured in short time frames.

When the Japanese have done something like this to enter a commercial or industrial field, we have called it "targeting" -- a word of opprobrium. At least this is better than having non-technical people or people with special axes to grind trying to pick winners and losers among proposed technological products aimed at the market place, and to support only the proposed winners with government funding, R&D consortia, etc. This approach seems to assume that the international competitors will stand still, waiting for the U.S. to catch up.

Let me give just one example of the dubiousness of this approach to product development. Two years ago a big debate began about the revelation that the U.S. was far behind Japan in the development of High-Definition TV (HDTV), and massive government programs to overcome this defect were proposed. In fact, DARPA began to fund the development of high-resolution, flat-screen displays of the type needed for HDTV, on the grounds that such displays were needed for military aircraft. The one remaining U.S.-owned TV manufacturer has requested government financial assistance to enter the HDTV field; the funding proposed is of the order of $10 million. In contrast, Japan's public broadcasting company, NHK, is estimated to have invested about $1 billion over the past 20 years in HDTV and now has a system in operation, albeit a limited one due to the high initial cost of the receiver sets. Some Americans have claimed that the U.S. can overtake Japan by leapfrogging the current Japanese technology -- that is, by developing digital HDTV instead of the analog system now employed by NHK. I am certain that the U.S. could do this, but not for $10 million and probably not for 10 times or maybe even 100 times this amount.

In Japan, the funding for HDTV development came only in small part from appropriations by the central government. NHK operates as a regulated public corporation, using revenues from its operations to pay for its expenses. What is more, the manufacture of receiving sets made to NHK specifications is being performed by the strong and competitive electronics industry; as demand for the receivers increases, the price for them is expected to drop substantially.

In order to send HDTV signals, which are broadband and not equivalent to the signals of conventional TV sets, either special optical fiber networks or direct broadcast TV satellites are required for best performance. The former have been developed in Japan largely by NTT, the public corporation responsible for telecommunications. The latter have been developed by NASDA, Japan's space agency, using both public and NHK funds, and with the technical assistance of U.S. contractors. In other words, a coordinated approach to HDTV has been employed through which all of the subsystems are developed simultaneously and in consonance. I suggest that it is probably too late to emulate Japan in this regard, taking into account the restraints of time and money. Furthermore, we lack the central coordination mechanisms required to insure that government, quasi-government agencies (if any), and private industry work together in a well-planned, long-term, and concerted effort leading to a commercial application.

Next I would like to turn to a broader analysis of the implications of technology development in Japan for the United States. In doing so, I will rely on a year's study of American and Japanese perceptions of Japan's place on the world scene, the results of which I have published as a series of four essays under the title Japan as a Scientific and Technological Superpower (NTIS document PB90-234923, October 1990). My study was based on approximately 100 interviews conducted in the U.S. and Japan, together with an extensive review of the current English-language literature.

The essays are entitled "Japan's Strengths and Weaknesses," "Japan's Technological Development Plans," "Key Technologies for the Next Century -- Research Plans and Possible Developments," and "Internationalization." Of these, "Japan's Strengths and Weaknesses" seems to be the closest to the present interests of the Subcommittee and I will limit my comments here to this subject. My findings are as follows:

The Education System

- A superior secondary education system in Japan results in a national literacy rate exceeding that of all other large advanced nations, but university and post-graduate education -- particularly in science and engineering and the conduct of academic research and development -- lags behind equivalent efforts in the West. Nonetheless, Japan is producing a large number of qualified engineers and scientists for the work force. The general population is highly literate in science and technology and generally supports technological change.

- Strenuous efforts are being made to increase the quality of research in universities, but limited government budgets seem to preclude the large financial investments that are needed for facilities, equipment, and support personnel.

- Provided that political and economic friction with the U.S. and other countries does not interfere, Japan will continue to send promising scientists and engineers abroad, partly for post-graduate education but mostly to be research participants. The process is intended to provide acculturation and the establishment of personal relationships as much as it is for acquiring technical knowledge.

- A bifurcated university structure, consisting of national universities financed by the central government and private universities that receive only minimal government funding, is inherently inefficient. However, there does not appear to be much pressure to upgrade the quality and importance of the many private universities insofar as science and engineering are concerned, so the national universities will remain the focus of excellence in these fields.

- Although Japanese universities do not draw many Western students, scientists, or professors, they are becoming of increasing importance in training students from Asian countries. Japan expects to have 100,000 foreign university students enrolled by the end of the century, many of whom will become technically trained. U.S. attempts to increase the number of American technical students in Japanese universities are only modestly successful, although opportunities for study in Japan have increased markedly.

- Resistance is being encountered among older professors in attempts by the Ministry of Education to change the traditional structure for performing research in national universities, but there is significant evidence to support the contention that the old system is breaking down and that a much more efficient research process will result. Among the important changes being observed are an increase in mobility of young professors and researchers between universities and greater recognition of the work of the younger scientific generation.

- In a country where political conservatism dominates the industrial sector, the universities have been outposts of liberalism, sometimes bordering on the extreme. This dichotomy has led to strained relations between academics and industry and has inhibited technical cooperation of the kind seen in the U.S. The problem is well recognized and the Ministry of Education has instituted measures to reduce existing legal and cultural barriers to industry's support of academic R&D and to the exchange of scientists and engineers between academia and industry.

- Traditional rivalries and jealousies among government ministries and agencies charged with supporting R&D have led to unnecessary duplication of effort and to squabbles over program responsibilities and funding shares. These conditions still exist but are being tempered to a limited extent by the availability of funds from sources other than the tax base. As one consequence, university professors are appearing in increasing numbers as members of advisory committees for other ministries or are the recipients of research funds from those ministries.

Scientific Manpower

- Japan employs a higher proportion of R&D personnel in its manufacturing work force than does the U.S. There is a continuing demand for young engineers which may not be met in the future because of (a) aging of the population, and (b) a decline in interest in engineering as a profession due to higher salaries paid and greater opportunities for promotion in the business and financial sectors.

- Japan graduates far fewer PhDs in the sciences and engineering than does the U.S. but devotes much more attention to in-service education and training of technical personnel after they have entered employment. Although the use of foreign scientists and engineers is expected to increase to partially meet shortfalls in selected disciplines, this trend is not expected to be as significant as it is in the U.S.

- As Japan begins to increase its investment in basic research, the demand for a larger number of PhDs or their equivalent can be expected to increase correspondingly. There is little evidence that a major push in this direction is occurring, and in fact an abnormally large fraction of newly graduated PhDs is unemployed.

Financial Resources for Supporting R&D

- The funding of academic R&D in Japan follows a markedly different pattern than that of the U.S. The prestigious national universities conduct a disproportionate share of all academic R&D and are funded essentially entirely by the central government. The magnitude of these funds is roughly equivalent to that of the U.S. Government for university research, but in the U.S. many other sources of funds are available to universities. Although the science and technology budget of the Ministry of Education has been increasing at least 5% per year for the past several years -- in spite of severe budget stringency within the central government, this is insufficient to support "big science" projects of the kind seen in the U.S.

- There is more talk than action in Japan about increasing government funding of basic research. Reorientation of existing R&D programs and the creation of new basic research programs is being performed largely within severe budget constraints, although sources of funds other than the tax base seem to be becoming available for these purposes.

- The financing of defense R&D is difficult to quantify, since most funds for this purpose are hidden within hardware procurement contracts as after-the-fact reimbursement for R&D expenses already incurred. Direct and open funding of defense R&D through the Japan Defense Agency's research institute has amounted to only about 5% of the total government R&D budget, but is now increasing. Even so, it must be recalled that industry supplies about 80% of all R&D funds spent, in contrast to about 50% in the U.S.

- Sharing of R&D costs by industry in government-sponsored projects appears to take place only with considerable reluctance by the industry participants. Maintenance of harmony and the commitment to political stability may be more important factors than the R&D itself. Usually only large companies are engaged in such projects, and their financial contributions are relatively small compared to their individual R&D budgets. Most industrial R&D conducted under the aegis of the Government is at the pre-competitive level, so that sharing of results does not overly interfere with individual proprietary positions. The advantage of such projects to the Government is that they tend to set a course of development that is consistent with the nation's industrial policy, but of course the partial use of private funds also extends the number of projects that can be supported by the Government.

- The economic success being enjoyed by Japan has resulted in large surpluses of government income over expenses. However, the surpluses are not being used to materially increase government support of R&D or hence to increase the ratio of government to private spending on R&D.

Cultural and Institutional Influences

- Traditional competition among government agencies for R&D funds and program responsibilities remains high and tinged with animosity, but a somewhat better degree of cooperation in the joint support of specific programs seems to have developed -- especially in the use of funds made available through revenues from the conversion of public corporations to joint stock companies partly owned by the public.

- On balance, Japanese economic and technological successes appear to have resulted in an increase in the proportion of technical publications in the English language -- contrary to the expectations of some foreign observers. New government and private efforts in Japan to enhance the flow of technical information to other countries are evident. Teaching of English as a second language continues to prevail and to increase in quality through the use of imported native-language teachers. Conversely, Japan is encouraging foreigners to learn Japanese, both within the country and abroad. Notwithstanding sporadic efforts in the U.S. to develop Japanese-to-English machine translation, Japanese development of this technology is at the forefront and is approaching the point of being commonly available in both Japan and abroad at varying levels of sophistication.

- Much is made in Japan about the necessity of increasing the quality of life there to match the standard of living seen in other advanced countries. However, there does not appear to be any identifiable policy in Japan for restructuring R&D policies to provide specifically for this objective. For example, government spending on environmental R&D has not increased significantly. Industrial R&D continues to be oriented toward manufacture of products with large export market potential.

- The notion held by many abroad that the Japanese are not creative in a scientific sense has evoked feelings ranging from hurt to indignation among politicians and the general public.

Scientists are more reserved, noting that Japan must contribute more in the way of basic scientific discoveries before it will be honored with more Nobel prizes or the equivalent. The scientists also point out that their research must be published in top-level scientific journals and in English if their work is to attract international attention. Notwithstanding protestations to the contrary, there is little doubt that Japan would like to be the beneficiary of international recognition for its scientific competence, equivalent in some degree to its acknowledged technological competence.

- With the preponderant volume and strength of Japanese technical creativity lying within the industrial sector, any large increase in the amount of basic research conducted will necessarily be the responsibility of industry. One motivation might be the fear of being cut off from the results of basic research conducted abroad. However, so far there is no indication that industry is assuming increased responsibility for or increasing its investment in truly fundamental research. Rather, an increase in overall R&D expenditures is apparent, consistent with the view that private investment in research not tied directly to business objectives is unreasonable.

Absorption of Foreign Scientific and Technical Information

- Knowledgeable people in both the U.S. and Japan unanimously agree that Japan's technological successes have depended heavily upon the infusion of foreign science and technology. However, Japan has moved from a "catch-up" mode to one of relative technical equality or equilibrium with the West, so that current transfers of technology to Japan are much more sophisticated than in the past. Japan has become a major exporter of medium-level technology to developing countries and is gradually increasing exports of advanced technology to the West.

- Techno-nationalism and a degree of xenophobia have caused Japan to seek to free itself of dependence on other countries in certain areas of technology. To some extent this push has been caused by reluctance or refusal of other countries to make available sensitive technology -- either for strategic or economic reasons. In a number of instances, especially in the aerospace and nuclear energy fields, the Japanese have been able to develop complicated systems without external assistance. Recognition of Japan's competence in applying technology to the marketing of successful commercial products is leading to increased sensitivity abroad about permitting transfers of technical information of all sorts to Japan.

- The Japanese are fully aware of the antagonisms that have been engendered because of their economic strength. In reaction, they are trying to demonstrate increased openness through what is called "internationalization". Government funds are being used to increase the presence of foreign scientists and engineers, and the larger private companies have announced policies for hiring foreign technical personnel. Conversion of both public and private technical databases to permit access in English is in process or already accomplished. However, the impression abroad is still strong that Japan enjoys a considerable advantage in obtaining advanced technical information from other countries.

Forecast

- Bureaucratic inertia and resistance, coupled with limitations on spending, will limit the rate of improvement of higher education and academic research in Japan, but positive changes already are observed and more will come in due course.

- As long as Japanese industry remains in its currently healthy condition, national R&D expenditures will continue to increase as industry plows back profits into the innovation process. Little of this money will go toward support of academic research in universities or in increasing the proportion of fundamental research performed in industry.

- The overt investment in defense R&D will continue to grow at a faster pace than for other R&D categories, although the hidden investment may not increase at the same rate.

- Improved technical relations among the government agencies in Japan can be expected, because this is logical and cost-effective. However, a fully coordinated government in science and technology matters would require a sea change in political and bureaucratic structure -- reflecting, for example, a much greater national interest in improving the social condition.

- Japan is demonstrating constantly increasing prowess in both basic and applied research, mostly through the efforts of the private sector, but the size of the country and the inherent limitations of manpower and resources will preclude Japan from surpassing the U.S. as the leading power in research.

- Unless faced with overwhelming antagonism from the U.S. and Europe, Japan will try to maintain strong technical relations with advanced nations of the West, not only to assure markets but also to continue to absorb new scientific and technical information as it is developed. Other countries will measure Japan's sincerity and reciprocity by observing the extent to which Japan acts in kind. Opportunities for complaints and friction will remain and may increase.

Implications for the United States

- From the point of view of industrial competitiveness, lessons can be taken by the U.S. from the Japanese model to increase the technical quality and literacy of the American industrial work force, to accelerate the process of converting scientific knowledge to industrial practice, and to be more alert to the results of R&D being carried out in Japan and elsewhere.

- Political circles in the U.S. have been unable to resolve mixed feelings about increasing Japanese scientific and technological prowess. Japan is still being treated as a second-class nation in terms of its scientific abilities, even though Japan now surpasses most of the other nations of the world in this regard. Those who believe that the U.S. can dictate the terms of the technical relationship may find that they have forced Japan into a greater degree of self-sufficiency.

- An increasing number of thoughtful science policy makers in the U.S. are beginning to question the advantages of devoting a large proportion of scientific manpower and government funds to pure research. A readjustment of resources in the U.S. to increase the proportion of applied research and development is no longer out of the question. The Japanese system is being looked upon as one that might be partly emulated.

- Large-scale industrial R&D projects funded jointly by government and industry are on the decline in Japan as effort shifts more toward research on advanced technologies. Yet the principles employed in the past for creating Japan's large-scale projects are being used to justify current U.S. emulation of them. A reexamination of the value of large-scale joint projects to the U.S. might be in order.

- The worst mistake that U.S. policy makers and industrial leaders can make is to underestimate Japan's technical capacity and determination to succeed. Attempts to isolate Japan from Western science and technology will also act to spur successful indigenous development.

- By giving Japan greater credit for its achievements and treating the country with more respect and less suspicion (as we do with Western European allies), Japan can be drawn into an even closer scientific and technological relationship with the U.S., to our advantage.

These words were written during 1989 and early 1990. Not very much has happened in Japan or in the U.S. to cause me to change my views, with the possible exception of the impact in the two countries of the enormous political changes in Eastern Europe and the Soviet Union and of the Gulf War. More and more American scientists and engineers are being sent to Japan to perform research (often at Japanese expense) and access to the Japanese technical literature is improving steadily. However, the respective governments have not been able to resolve political and economic differences to the point where they would be comfortable with true interdependence in science and technology.

In conclusion, and perhaps most important of all, I would like to note for the benefit of the Subcommittee that a rather elusive trend that I had observed during the course of my investigation has been illuminated much more clearly. U.S.-based multinational corporations are substantially increasing their investment in research facilities in Japan, to the point where it is truly significant. My colleague, Dr. Bruce Rubinger of Global Competitiveness Corporation, and I have now documented this trend in a survey we have performed for the National Science Foundation. Our report, *Survey of Direct U.S. Private Capital Investment in Research and Development Facilities in Japan*, is in the hands of NSF and should be available to the public soon. It shows that at least 71 U.S. corporations have R&D facilities operating in Japan or are constructing them; that they are pleased with the performance of these facilities and in many cases plan to expand them; that they have not experienced undue governmental interference; and that their most serious problem is acquiring sufficient professional staff members. This presence will act to demystify the Japanese R&D culture and will tend to make U.S. corporations with manufacturing operations in Japan as effective as their Japanese counterparts. The Subcommittee's attention also is called to an article on this same subject that appeared in the March 25, 1991, issue of *Fortune* magazine, entitled "Picking Japan's Research Brains." The theme of this lively article is that at last U.S. companies are turning outward by acquiring technology from Japan, partly through locating laboratories there.

Whether this trend toward learning from the Japanese and toward a new climate of technological interdependence will continue and thrive lies to a great extent in the hands of the Congress. It is becoming more and more apparent that the popular sport of Japan-bashing may be acting to hurt U.S. interests in Japan as much as anything else. I hope that wiser heads will prevail.

Justin L. Bloom

Justin L. Bloom is a chemical engineer by profession. He was graduated with honor from the California Institute of Technology in 1948 and was employed subsequently as a research engineer or program manager by Shell Chemical Corporation, Standard Oil Company of California, Lawrence Livermore National Laboratory, and Martin Marietta Corporation. Later, during his 24 years of service with the Federal Government, he worked for the U.S. Atomic Energy Commission as a branch chief in the control of nuclear materials and in the development of applications of radioisotopes. He then became the technical assistant to Chairman Glenn T. Seaborg and other Commissioners of the AEC.

In 1973, Mr. Bloom joined the Department of State, and in 1975 was assigned to the U.S. Embassy in Tokyo, where he was the Counselor for Scientific and Technological Affairs until 1981. He then held the same position at the U.S. Embassy in London until 1983. Upon his retirement from the Foreign Service in that year, Mr. Bloom became President of Technology International, Inc., a consulting firm specializing in international technology transfer matters which provides services to government agencies, universities, and private corporations.

In addition to carrying on his consulting practice, Mr. Bloom is also active as a member of the Department of State's Advisory Committee on Oceans and International Environmental and Scientific Affairs. In the recent past he served on the National Science Foundation's Advisory Committee on International Programs, the National Research Council's Committee on Japan, the International Affairs Committee of the Energy Research Advisory Board, the Board of Directors of Volunteers in Technical Assistance (VITA), and the Board of Directors of the Hitech Engineering Company. He is a Fellow of the American Association for the Advancement of Science and a member of the American Institute of Chemical Engineers, the Japan-America Society of Washington, and the Washington and Southeast Region Seminar on Japan. He is also the Honorary Chairman of the American Technology Transfer Association and an Advisory Editor of Infomediary.

Mr. Bloom has published more than 60 articles in the technical and business literature and he holds three patents. He received a Presidential Meritorious Service Award in Ocober 1983 for his work as a science officer in the Foreign Service.

Mr. VALENTINE. Thank you, Mr. Bloom.

Ms. Kotler.

Ms. KOTLER. Thank you, Mr. Chairman.

I am going to summarize my statement, and I very much thank you for inviting me to speak to the committee and be with this distinguished panel. Besides submitting my statement, I would like to include a speech by Juro Nakagawa on the Japanese information gathering and something by—an article on the German National Research Center for Computer Science by the U.S. Office of Naval Research.

Mr. VALENTINE. Without objection.

Ms. KOTLER. Okay. Thank you.

The Japanese advantage, which we are talking about today, is not just, I don't believe, a question just of their science, their corporate organization, their ability to raise capital, their quality, their management, or their marketing, nor is it just simply their luck at picking winners. It is, in fact, nothing to do with luck, it is the simple fact that the Japanese have done their homework and they have done it well. They know where to look for science, they know where to look for technology, and they know what the markets will bear, and they know what will win. They do not enter a venture or target an industry or consider a science or technical area without being prepared.

The Japanese, in my view, have an information advantage, and it has created a gap that grows wider and wider every day between the United States and Japan. It is, I believe, profound and clearly underlies and aggravates the already well recognized gaps in trade, technology, and education between Japan and the West.

In my view, the Japanese advantage is largely due to the success of its government and corporate cooperation in information gathering efforts. Japan's intellectual, organizational, and political tradition all work to encourage this important advantage.

Americans and Japanese, to start, simply define information and, thus, its importance differently. Most Americans would view information as a simple collection of facts and believe it to be free, like an element in the atmosphere, for all to use, to acquire, and to share. The American tradition is one of information openness reinforced by a system of public libraries, open congressional hearings, guaranteed access to most Government documents, enhanced by the Freedom of Information Act, and constitutional safeguards for a free press and free speech.

In Japan, however, the current word used for information simply did not exist in the Japanese language until the late nineteenth century. It is a fabricated word, and it first appeared in a translation of Clausewitz's "On War," and it meant military, though not necessarily secret, intelligence. It meant understanding the enemy or your adversary's political, economic, and historic strengths and weaknesses. The Japanese still use this word to imply intelligence.

The Japanese concept of information, in contrast to the American one, is something dynamic rather than static, integrated, rather than random, and targeted for application. Especially in the race to commercialize technology, the Japanese collect information as intelligence—in other words, in a context and actionable.

A simple search only for science and technical documents is viewed by most Japanese misdirected and, in fact, a bit confusing. Japanese information gathering is holistic. No technical fact is acquired out of context. Who is the researcher? What is his lab like? What are the economic conditions of his country and his company? Who does he report to? What is the Government policy towards his technology? And so on.

The role of the Japanese government in this information collecting and generation of scientific information also diverges from the U.S. pattern, and the bulk of research done in Japan is done within corporations, and it is rarely basic and always proprietary. Government, industry, and university cooperation in this applications research further limits access to Japanese S&T information which ordinarily might be easily accessible in the West.

The Japanese government and corporations are information gathering machines. Every opportunity is used to collect information. Lawyers, lobbyists, consultants, think tanks, conferences, trade associations, study missions, company acquisitions, investments, graduate students, and so on, are all there to collect and understand information and technology.

JETRO, the Japan External Trade Organization, Japan's trade promotion arm, spends four times as much in the United States as the U.S. Commerce Department does both in the U.S. and Japan on understanding the Japanese market. There are over three times as many Japanese trade associations in Washington alone than there are U.S. ones in all of Japan, and, in fact, when I called the Commerce Department to confirm that number, they weren't even sure how many trade associations there were in Tokyo, American ones.

The Mitsubishi Research Institute, which collects U.S. Government S&T documents for resale in Japan, alone, spends more in a single year than the whole budget of the Japan Technology Program in Commerce, which is tasked with collecting Japanese S&T information. This program has only one full-time staff person.

The Japanese government role in obtaining vital information for the economic well-being of a nation is the Japanese advantage. As one Japanese economist wrote in trying to describe Japanese economic planning, "Whatever the demerits of the system of industrial policies in post-war Japan, it has been a very effective means of collecting, exchanging, and propagating industrial information. Probably information related to the various industries is more abundant and easily obtainable in Japan than in most other countries. Viewed as a system of information collection and dissemination, Japan's system of industrial policies may have been among the most important factors in Japan's high rate of industrial growth apart from the direct or indirect economic effects of individual policy measures."

Recently, the general manager of new ventures development for a Japanese trading company concluded a discussion of Japanese information collecting by observing, "In the coming years, those corporations and individuals that collect and utilize information properly will control the future of the business world. In the past, labor, land, and capital have been the traditional factors of production.

However, today information and energy have become the fourth important factor in economic development."

General Schwarzkopf, when trying to explain the failure of the Iraqi army, he simply shook his head and said it was a failure of intelligence. It is not a question of not being invented here, it is a question of head in the sand. American industry is going to have to believe that this is true if it is going to compete successfully.

Thank you.

[The prepared statement of Ms. Kotler follows:]

INFORMATION STRATEGY: THE JAPANESE ADVANTAGE

Statement by Mindy L. Kotler, President
Search Associates, Inc.
International Research

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An information gap exists between the U.S. and Japan. It is something more profound than just another example of superior Japanese management or another co-opting and perfecting of a Western concept by Japan. It is a pervasive and basic phenomenon that has thus far gone almost completely unperceived. It underlies and aggravates the already well-recognized gaps—in trade, technology, education—between the U.S. and Japan.

The problem is not that the two sides of the Pacific suffer from any shortage of discrete facts about each other. There may actually be too many details floating about, too many data on record. But possessing information does not necessarily equate with knowing what it means or understanding its value. In Japan, information and information gathering are viewed as an important commodity and activity.

It is increasingly popular in the U.S. to equate information with power. Nevertheless, in practice Americans rarely value it in that sense. Information is seen as simply a collection of facts and data, of disparate news and statistics. Americans believe it is free, like an element in the atmosphere for all to use, to acquire, and to share. The American tradition is one of "information openness."

The U.S. system of public libraries, open Congressional hearings, guaranteed access to most government documents (enhanced by the Freedom of Information Act), and constitutional safeguards for free speech and a free press all reinforce the notion that information is free. More important, the free flow of information from the government to its citizens and vice versa is considered essential to a democratic society.

The Japanese Definition of Information

The Japanese have a different view. Information is neither free nor devoid of content. Jono, the Japanese translation for the word information, is an expression of recent currency with a shadowy past. It is a word that describes a purpose and a method, and is not merely a description of fact. Maybe more important, information is a learned skill.

Joho is one of the many words adopted and created by the Japanese to help them understand, define, and explain the West. Until Commodore Perry's Black Ships appeared in Edo Bay in 1853, Japan was content in its isolation, and its leaders were satisfied that they had enough facts about the outside world. Japanese who dared travel abroad and who then returned to their homeland were, by imperial edict, to be executed. The aggressive expression of the West's military might and technical power forcibly impressed upon the Japanese that they had something to learn from foreigners. An "information gap" had appeared. Knowing about the existence of Western technology was different from understanding what that technology could do.

Until the late 19th century and the beginning of Japan's urgent efforts to modernize and learn about the world, the word joho simply did not exist. Joho first appeared in the late 1880s in a Japanese translation of Clausewitz's Uber den Krieg (On War). The translator fabricated the word joho to describe military intelligence and to mean "all the knowledge concerning the hostile party and countries." He combined two Chinese characters or ideograms: jo, which can mean the feeling of man's mind or the state of affairs, and ho, which can mean to feed back or to inform. The combination, "to inform on the state of affairs," is thus both a statement of fact and the description of an activity.

For the next fifty years, joho was associated with military affairs and military intelligence, though not necessarily secret or espionage-acquired intelligence. In the Ministry of Foreign Affairs, the Chubu Joho-Kyoku or Intelligence Bureau was created to collect and analyze foreign political affairs. This bureau still exists, although its activities are now more akin to those of the United States Information Agency (USIA).

It was not until after World War II and the growth of Japanese commitment to science and technology that the word joho reappeared and began to take on its more benign contemporary meaning. At first used to describe the activities of the emerging computer and information-processing industries, joho quickly came to connote the broader sense of learning, knowledge, and information. Today, it is one of the words most frequently used in Japan's press.

The meaning of joho, therefore, changed as the information needs of the state changed—from promoting military might to developing and safeguarding industrial strength. Probably not coincidentally, broader connotations of joho developed at the same time as the Japanese government established JETRO (Japan External Trade Organization) in 1958, and JICST (the Japan Information Center of Science and Technology) in 1957—two organizations committed to collecting foreign information and expanding market opportunities abroad.

Joho, in all of its permutations, never meant only the mere collection of facts. There has always been an implicit understanding that information is intelligence—pieces of a puzzle to be organized for some purpose. Information, under this concept, has an intrinsic meaning and demands to be put into some sort of broader context. Looked at in this way, the long-noted relentless pursuit of every detail on any subject by everyone in a Japanese organization makes a great deal of sense. The Japanese concept of information in contrast to the American one, is something dynamic rather than static, integrated rather than random and targeted for application.

How the Japanese Collect Information

Today's Japanese information-gathering machine is a multi-billion-dollar industry. In Washington, lawyers and consultants are constantly amazed by the number of requests for information and analysis they receive from the Japanese. These advisers are further astonished that the same questions are farmed out to a number of firms and individuals as well as to executives within the Japanese company itself. Information is used not only to explain but to reduce uncertainty and to plan strategy.

For example, in the early 1970s Japan's electric power industry established a Washington office to track the regulatory and technological development of the U.S. utilities. The office and its consultants, in painstaking detail, tracked legislation, monitored technologies, toured power plants, and followed trends in power generation. By the 1980s, the acquired understanding of the U.S. utility industry helped guide the surge of Japanese investment, having exposed many of the direct costs of American competitors and provided early warning of technical advances in power generation and transmission that U.S. companies might want to market in Japan before the Japanese could perfect them. Today, the Japanese power companies are joining American utility trade associations and beginning to build their own for-profit power plants in the U.S.

S&T Information Collection

In the context of this hearing on "Japan's advantage in the commercialization of technology," it is important to understand that the information considered necessary for Japanese to succeed is not confined to S&T literature. Simple acquisition of scientific or technical documents, as many American firms have discovered, is a confusing, expensive, and often unproductive exercise.

I believe that the American penchant for issue- and time-specific information searches, especially in S&T, is viewed by most Japanese as distracting. Japanese information gathering is holistic. No technical fact is acquired out of context: Who is the researcher? What is his lab like? What are the economic conditions of his country and his company? Who does he report to? What is the government policy toward this technology?--and so on. The Japanese are interested in intelligence, classically defined as actionable information, not just facts.

Hal Morimoto, co-founder of Comline, a provider of Japanese S&T information to Westerners, has noted that most non-Japanese companies "tend to gather information only on specific topics, regardless of country of origin. Japan selects those countries that are of strategic importance and collects information on all aspects of that country. In contrast, most foreign companies [non-Japanese] appear not to have enough interest in Japan as a whole." (Morimoto, p. 25) In other words, S&T information, taken out of its political, economic, social, market, organizational, and financial context is meaningless.

Japanese S&T Information

The differing ways in which S&T information is produced in the U.S. and Japan also has important implications for its dissemination and collection. The predominant role that Japan's private sector plays in scientific research severely limits foreigners' ability to access technical developments in Japan. Corporate and university research in Japan is rarely basic or nonproprietary.

Government-sponsored research in both countries is generally basic, green-field research and, as such, understood in the international scientific community as a necessary public good. The very nature of basic scientific research demands that information, if it is to have any value, must be distributed and debated freely and widely. In addition, tax-payer funding makes non-national security related research a public asset; again, something to be openly available.

Industrial research, often referred to as either applications research or engineering, is by its very nature proprietary. It is a corporate not a public asset; it is a trade secret. The major share of research in Japan is taking place within the private sector and is applied. This situation naturally reduces the proportion of potentially public information, especially in technology. More important, the intense cooperation and collaboration among industry, government, and universities in Japanese technology development further precludes the release of "proprietary" information. In the U.S., university and government involvement would make most of this information public.

Japanese Government Information Collection

The level of government effort in the collection of trade information—vital to commercialization of technology—is also an important point of contrast between the two countries. For FY 1991 the U.S. plans to spend $5 million for trade promotion and staffing of the U.S. Foreign Commercial Service in Japan. The USFC has 34 staff in Tokyo, of which 13 are Americans; 2 Americans and four foreign nationals in Osaka; one foreign national in Fukuoka; and one foreign national in Sapporo. Only five U.S. trade associations and 27 U.S. agricultural organizations have offices in Tokyo.

In contrast, the Japanese are planning to spend over $18 million this year in the U.S. for the Japan External Trade Organization (JETRO), the international commercial research and trade promotion arm of MITI. JETRO has 9 offices in the U.S., and all have Japanese staff as well as American nationals. Recently, Japan has been encouraging exporting to Japan by stationing JETRO officials in the trade promotion offices of 15 U.S. state governors' offices.

The largest JETRO office is in New York, with approximately 75 people, of whom half are national hires. Chicago and Los Angeles are the next largest, with approximately 25 people, again with half of them national hires. The budgets of their two offices are approximately $2.5 million each. There are approximately 10 Japanese trade associations in New York and 2 in Chicago.

Information in Washington

Washington, D.C., is considered the information capital of the world, especially to the Japanese. Mitsubishi Electric feels that political and economic information is so important to its operation in the U.S. that the president of Mitsubishi Electric America, the man who overseas all the U.S. operations, sales, service, acquisitions, and manufacturing, has his office in Washington. I do not know of one U.S. CEO who has intentionally moved the offices of a corporation away from the center of its commercial activities to be in Washington.

The much-debated numbers on Japanese lobbying expenditures in Washington are also best viewed as a reflection of Japanese interest in information. It is my impression that many of the lobbying expenses are simply for information gathering and that only the more conscientious lawyers and lobbyists bother to register as foreign agents. In any case, the bulk of the work done for Japan in Washington is for information collection and analysis, not for representation. These activities are not covered by the Foreign Agents Registration Act. I would estimate conservatively, therefore, that the amount that Japan spends on information in Washington is twice the $150 million tallied by the Office of Foreign Agent Registration at the Justice Department.

The Washington information-gathering activities of consultants, lawyers, lobbyists, and PR firms are supplemented by the Washington offices of nearly every major Japanese trade association, trading company, and corporation. The average Japanese trading company or sogo shosha reportedly transmits more documents daily than the Japanese Ministry of Foreign Affairs. There are estimated to be 16 trade and quasi-governmental organizations and 45 corporate offices in Washington. If you estimate approximately $300,000 per office, the total figure is nearly $20 million.

In addition, Japanese membership in Washington think tanks must be viewed, as it is by the Japanese, as another opportunity to access Washington information. The principal asset that these organizations have is personal networks and contacts. I recently completed a study of Japanese spending on think tanks, and estimate that they spend approximately $5 million per year on participating in think tank activities. According to Japanese representatives I interviewed, the think tanks are considered an important, private window on the Washington policy community. Because these institutions are not official government organizations and do allow for a free exchange of views, they are not subject to U.S. freedom of information regulations. In other words, as it was explained to me, a public policy question can be asked and answered without a paper trail.

The Japanese Overview

Most of what the Japanese do is legal and aboveboard. Most information is not secret, and what little is secret can be deduced. Even the myriad listening posts, sales offices, "informational" job interviews, and trial purchases are not breaking any laws. Japanese purchases or investments in hi-tech companies to acquire technologies are welcome. More recently, Japanese firms have simply been forming cooperative R&D ventures with small, risky firms possessing experimental and emerging technologies. These alliances help the large Japanese conglomerates reach new, niche markets quickly and cheaply. (Gupta)

Richard Deacon, in his book, A History of the Japanese Secret Service, estimates that some 85 to 90 percent of Japanese government intelligence gathering is directed at making the economy more successful. (Deacon) The government role in obtaining vital information for the economic well-being of the nation is the Japanese advantage. In an article on "Planning in Japan," Tokyo University economist Ryutaro Komiya wrote:

> Whatever the demerits of the system of industrial policies in postwar Japan, it has been a very effective means of collecting, exchanging, and propagating industrial information. Government officials, industry people, and men from governmental and private banks gather together and spend much time discussing problems of industries and exchanging information on new technologies and domestic and overseas markets conditions. People at the top levels of the government, industries, and banking circles meet at councils, and junior men meet at their subcommittees or less formal meetings. Probably, information related to the various industries is more abundant and easily obtainable in Japan than in most other countries. Viewed as a system of information collection and dissemination, Japan's system of industrial policies may have been among the most important factors in Japan's high rate of industrial growth, apart from the direct or indirect economic effects of individual policy measures.
> (Komiya, p. 220)

Many lament that corporate America suffers from the NIH—not invented here—syndrome. It hard to accept today that any U.S. company believes it has a monopoly on innovation. The real problem, I believe, is an HIS—head in the sand—syndrome. If we don't see it, it must not exist or have any value.

Speaking to the Sixth Annual Conference of the Society of Competitor Intelligence Professionals, Juro Nakagawa, general manager of new ventures development for Nichimen Corporation, concluded his discussion of Japanese information collection by observing:

> In the coming years those corporations and individuals that collect and utilize information properly will control the future business world. In the past, labor, land and capital have been the traditional factors of production. However, today, information and energy have become the fourth important factor in economic development."
> (Nakagawa, p. 11. Attached is the full text of his speech for the record.)

I must agree. During Congressional hearings in 1986 reviewing the Commission on Federal Paperwork, information was defined as "a valuable national resource no less essential to the survival of government, industry and the individual citizen than are human, material or natural resources. Information is a resource that is in need of conservation, recycling, and protection." (Caudle, p. 16)

American industry is going to have to believe this is true if it is going to compete successfully.

RECOMMENDATIONS

1) Increase the staff and budget of the Japan Technology Program (JTP) and NTIS Office of International Programs (IP). The JISCT annual budget to collect foreign S&T information is $103.7 million; the JTP and NTIS IP budgets are frozen at $400,000 and $500,000 (of which maybe 20 percent is devoted to Japanese programs and acquisitions), respectively. Here, it is interesting to note that the Mitsubishi Research Institute (MRI) was paid (until recently) $90,000 annually to collect Japanese S&T information for NTIS. At the same time, MRI alone paid NTIS over $350,000 to purchase U.S. NTIS documents. The JTP, which is tasked with tracking all of Japan's S&T, has a full-time staff of one.

2) Establish a Tokyo office of the JTP similar to the one established by the German GMD 15 years ago. With a staff of six, a director who has been with the office since its inception, and a $1.5 budget, the office collects and distributes S&T information to German organizations and provides a personal liaison with all relevant government and industry organizations and laboratories. Attached is a report of the U.S. Office of Naval Research on this facility.

3) Commission a thorough and scholarly study of Japanese information gathering in the U.S.

4) Establish a databank for American companies to anonymously record their successes and difficulties with obtaining Japanese information. This effort would provide the factual basis for the U.S. government and U.S. industry to indicate American information needs to the Japanese and identify true points of tension.

5) Promote and encourage the study of the Japanese language and the attendance of American scientists and business people at international conferences. Personal contacts are the single best way to access Japanese information.

6) The U.S. government should increase its efforts to obtain and to make overtly obtained business and economic information more available on a uniform access basis to American companies.

ENDNOTES

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Mr. VALENTINE. Thank you. I thank all of you.

I believe that if we are to begin to understand the problem, much less try to find a solution, that we have to be willing to talk about all of the possible problems, that there should not be any area that is off limits to legitimate discussion, and that because of the fact that we are willing to discuss certain things should not be an indication of one's feeling one way or the other.

With those opening remarks, let me ask each of you, if you would care to, and if you feel that you are in a position to do so, if you would discuss briefly the role that organized labor in Japan, the strength of labor, the lack thereof, and the situation with respect to labor in this country, what that has to do with the problem, and, more specifically, we were faced—we had to pass an Act of Congress to stop a railroad strike within the past couple of weeks. I happen to believe that railroad employees are among the best paid industrial workers in the Union. Would a strike of that kind—would that have been possible under Japanese law—the threat of national paralysis?

Mr. Nanto.

Mr. NANTO. Labor plays a very important role in Japan. Let me mention that in Japan there are two types of labor unions. In the private sector, unions tend to be enterprise unions. That means that Toyota has a union that is comprised completely of Toyota employees, and so instead of an industry-wide union, they have unions that are organized around companies, which means that if the union strikes the company, then only that company is hurt, and so there is the tendency not to engage in labor activities that will damage the company.

Mr. VALENTINE. Well, that is kind of like a little house puppy, isn't it?

Mr. NANTO. That's right, exactly, and so the unions tend to be quite cooperative with management, and, also, most management officials start out working in the union and work their way up the company—up the company ranks. So often the former head of the union will become one of the managing directors of the company.

Mr. VALENTINE. Well, is there some other kind of animal abroad in that company besides this little puppy? I mean can these workers become members of a—legally become members of a cohesive, strong union that could strike all of the Japanese auto industry at the same time, as is the case in the United States?

Mr. NANTO. There are umbrella unions. However, they tend not to coordinate their strikes in the private sector.

Now, in the public sector there is a totally different story, and so you have teacher unions, you have unions of government employees, you have railroad unions. However, in Japan the railroads tend to just have slowdowns rather than complete strikes in the government-run railroads and transportation.

Mr. VALENTINE. What is the reason for that? Are you saying that the sense of mission is shared by labor and management?

Mr. NANTO. In the private sector, yes.

Mr. VALENTINE. Would labor in Japan be concerned about a decision as to the future of the Japanese economy when it decided whether or not to strike?

Mr. NANTO. Yes. If you look at individual members of unions in companies, these members will have a perception of permanent employment. Now this may be true or may not be true, but when they join the company and join the union, they see themselves as being with this company for the rest of their lives, and so their future economic viability depends on the viability of that company, and so they tend to encourage and go along with activities that will strengthen the company rather than just redistribute profits within that company.

Mr. VALENTINE. Mr. Mendelowitz.

Mr. MENDELOWITZ. When the Japanese automobile industry began making large inroads into the American market, there was a significant debate over what the sources of the competitiveness of that industry were, and one of the arguments put forward was that the industry benefitted from a homogeneous, highly disciplined, passive, well trained labor force represented by company unions that had the interests of the company at heart rather than the workers, and I think that the extent to which that is a critical factor was really only answered when the Japanese automobile manufacturers began producing cars in the United States, and probably the most instructive case example is the case of NUMMI, the New United Motor Manufacturers, Incorporated, which is a joint venture between Toyota and General Motors operating out in Freemont, California.

This particular joint venture began producing cars in 1984 in a factory that had been a General Motors factory. General Motors operated this plant in Freemont from about 1962 to 1982 and then shut it down. They shut it down because there was excess capacity in the firm and this plant was one of the poorest plants that they had. Absenteeism was routinely running as high as 30 percent. Labor grievances were as high as 7,000 in a single year.

Mr. VALENTINE. Out of how many—

Mr. MENDELOWITZ. With 5,000 workers at the time, there were 7,000 labor grievances a year. I don't know how they managed to produce cars there, because if you only show up two out of every three days and the days you show up you are grieving a labor complaint, it is hard to imagine there was much opportunity left to produce cars.

Product quality was abysmal. The fields around the factory were backed up with vehicles waiting to be reworked, to be fixed, before they were sent on to the dealers to be sold to customers. And this plant was shut down in 1982.

It reopened two years later under the auspices of the GM-Toyota joint venture. GM provided the factory, Toyota provided the management, and because General Motors was a unionized plant the terms of the joint venture agreement between Toyota and General Motors provided that, number one, the former GM workers who had been employed at the plant when GM operated it would have first right of refusal of the jobs, and, secondly, that the UAW would not be opposed as the bargaining agent for the labor force.

The plant reopened in 1982—I'm sorry—reopened in 1984. The labor force was virtually 100 percent made up of workers who had worked there when General Motors ran the plant, and those workers were represented by the United Auto Workers. What was the result?

Absenteeism dropped from about 30 percent down to about 2 percent. Labor grievances dropped from 7,000 down—for example, in this past year when I was out there, there were 40 open labor grievances. Product quality: When the plant began operating, General Motors' internal audits determined that the quality of the cars being produced at NUMMI were the highest quality in the GM inventory in terms of absence of assembly defects, and in terms of efficiency of production it was about the most efficiently produced car they had. Toyota's internal quality audits determined that the vehicle was not substantially different in terms of quality from that which was produced by Toyota in Japan. Same workers, same union, same factory. What changed were the management systems.

Now it is true that in Japan the automobile industry benefits from single company unions. It is true that the industry benefits from a highly disciplined, homogeneous, well trained labor force. But the differences in the labor force and the differences in unionization are not the answers. The answers are the way in which labor force is managed.

The very fact that Toyota was able to go to NUMMI in Freemont, California, with a labor force which, in all intents and purposes, was a poisoned labor force based on the experience that GM had at that factory, and then turned that labor force around to be a highly productive, high quality labor force says a lot for the importance of the management systems and how labor is managed as opposed to whether or not the labor force is unionized.

Mr. CHENEY. Could I make a couple of points?

Mr. VALENTINE. Yes, sir, I wish you would. But let me add one other thing in the mix as we go through this. Would you comment, if you care to, on the—in addition to what I have asked you about the influence that labor—how labor figures in this or doesn't to consider the fact whether or not Japan, the labor structure, has a situation where organized labor can go on a strike—can strike, and the law says that it has to be rehired. And bear in mind that the Congress is considering legislation in this country where trade union members or laborers can go on strike and have their jobs absolutely guaranteed.

Now if you would proceed, Mr. Cheney.

Mr. CHENEY. I wanted to make two points. One is that early in the post-war era, Japan labor and management reached accommodation by which labor would agree not to oppose the introduction of new technology as long as management agreed to preserve the workers' jobs. So they had a sort of agreement about technology and jobs, and I think that was very effective. There wasn't the labor opposition to the introduction of new technology that was the case here.

The other point I wanted to make was that I think labor in the United States has changed quite a bit, and the Council, of course, is an organization of industry, organized labor, and universities, and a number of our labor union members are very aware that if they don't work together with industry to increase their competitiveness they won't have jobs at all, and they are solidly behind the Council's recommendations for improving competitiveness and technology.

I am sorry I don't know specifically the laws in Japan about what is permitted and what is not in strikes.

Mr. Valentine. Mr. Bloom, Ms. Kotler, would either one of you care to comment on that?

Mr. Bloom. I would, certainly, Mr. Chairman.

The labor-management relationship in Japan, I think, has to be considered unique amongst all advanced countries simply because of the points that you have identified—that is, lack of antagonism between labor and management, generally speaking. There are occasions when the unions, as Dick Nanto has pointed out, the national unions pertaining to government enterprises, do go on strike, disrupting things for a while, but usually these strikes are not long lived; they are sort of made to—they go on strike to make a point and then go back to work, and everybody seems to pick up where things left off.

I have seen personally in the years that I spent in Japan a number of situations that make one marvel at this ability to collaborate. I think you know some of the factors, because they have been so widely publicized in the U.S. For example, quality circles in Japanese manufacturing plants are made up of the plant laborers sitting down with management to—usually at the lower level of management—to work out real problems on manufacturing or assembly lines.

The interpersonal relationship between labor and management, between individuals in these two classes, is striking. For example, typically a foreman in a Japanese manufacturing plant is a professional engineer, maybe a junior engineer recently out of college. He is put on the manufacturing floor to gain experience in manufacturing because someday he may be rising to higher management. It is not assured, but at least he is given the broad training in that respect.

As Mr. Nanto also pointed out, members of management often serve in their early years as officials of the labor union in the company and as part of their work experience and then go on to more conventional management positions.

Another thing we should keep in mind is that, while the Japanese system of compensation in Japanese plants—if the company is doing well, bonuses are given at the end of each year, and labor and management share equally in those bonuses; no differentiation is made as to who gets bonuses; everybody gets bonuses. As you might expect, over the past 20 years bonuses have been awarded every year, and they have become almost a part of the salary system.

With all of this sounding very good, we should also recognize that in small companies there are no unions and there is no lifetime employment guaranteed, and so that—and these smaller companies make up the large bulk of the Japanese economy. So the union concept does not extend in the private sector to everyone, as it might through the national union system that we have here.

Just anecdotally, I will tell you one quick story about the situation I experienced personally. I arrived at Narita Airport one morning to take a flight back to the United States, and my flight was cancelled, and the reason why is that the crew of the aircraft I was supposed to be taking had gone on strike, and they struck for one day, just long enough to force the airline to cancel the flight, and they resumed their work the next day, and there was no penalty in any way towards those pilots and stewardesses for having gone on strike.

Mr. **Valentine**. Was it just that one airplane?

Mr. **Bloom**. Just one airplane. They made their point. That is all I have to say on that subject.

Mr. **Valentine**. Ms. Kotler.

Ms. **Kotler**. There is really very little I can add except to maybe point out that the NUMMI plant is not necessarily typical of Japanese auto plants in the United States. The usual siting of Japanese auto plants are for green field plants—new plants—and they are very meticulously placed in areas that do not have unions and have a certain homogeneity to their population.

Mr. **Valentine**. Thank you, Ma'am.

I will yield to other members of the committee, beginning with Mr. Lewis, but I do want to ask a question and ask you not to answer it, because I'll come back to it. I don't want to hog all the time, but I would want to ask you to try to add some symmetry to my discussion when we are finished with our colleagues and I come back. I want to talk to you a little bit about the other side of the coin. Are Japanese industrial tycoons—are the leaders in Japanese industry free to do whatever they want to do, as they are in the United States—can buy and sell—and is it the Japanese way for the president of a company to pay himself and his members of his staff and his stockholders millions of dollars while making it a part of the policy of the company to try to force the local government where the factory is located to lower the tax rate? And are there no restrictions on these people's ability to buy and sell and to break these companies up and close up a factory in an area where it has provided livelihood for people over the generations? They can do that in this country, and it's the American way, and nobody wants to stop it; maybe we shouldn't. My question will be, when we come back, can they do the same thing in Japan?

I yield to my good friend, Mr. Lewis.

Mr. **Lewis**. Thank you, Mr. Chairman.

I think it was very significant, your comments on the union-management relationship, and it does point out to me as an individual that the words that we hear so many times from the American entrepreneur, the CEO's of our major companies, the protection system that they have in Japan, and apparently they grow up with this system.

As you mentioned, Mr. Mendelowitz, the managers are former union members who rose through the ranks, so therefore when they get involved in a labor situation, they seem to be very cautious as to how they approach that. Rather than with arrogance, they do it with congeniality, rather than what we see here in this country, such as the IAM—the Eastern thing that caused the demise of Eastern Airlines.

I know from doing some negotiations in the GATT on the agricultural side the tremendous protectionism with the agriculture unions in Japan, where they basically control the Diet in a lot of areas, and that makes it very difficult for us in order to get a level playing field with them.

However, the impact on competitiveness, I think, has got to be realized here in this country and some way open those doors with Japan, and over the past decade Japan has averaged a 4.5 percent GNP growth, and the United States has averaged about a 3 over the same period. So it is my understanding the Japanese growth is mainly because of large exports and investment booms, and their investments were twice the United States' rate on a per capita basis.

So I would like to ask, basically, what has been the impact of the economic situation on the United States competitiveness? What is the impact of this economic situation on research investments? And what are the long-range estimates of GNP comparisons between Japan and the U.S.A. that you see at this point?

Mr. NANTO. As we look at what is happening in the United States in response to competition from Japan and from other overseas companies, I think during the 1980's the situation was fairly grim, where, with the over-valued U.S. dollar, a lot of U.S. companies having trouble competing, a lot of companies going overseas to try to search for lower labor costs, a lot of things were happening that were very negative.

However, as we closed out the 1980's, I think in many companies we began to see not just a glimmer of hope but a very bright ray of hope. There is occurring in the United States what I like to refer to as an international trade revolution. It is something like the Industrial Revolution that is affecting virtually every company that manufactures products and even many service companies in the United States.

When you talk to managers now and ask them to compare where they are now relative to the beginning of the 1980's, they will say that their quality control, their productivity, most measures of the production process within the company have improved tremendously over the 1980's. And as we closed out the 1980's, we also had many companies buying new plants and equipment, closing down some of the old, outmoded plants, and so there is, I think, in the United States a resurgence of companies who can compete in the international arena.

However, there still is a lack of appreciation of the need to be in Japan with a physical presence to sell there, even though it is very difficult to do so, in order to monitor what is happening in the market there.

For many products—and I think Cray Computer just discovered this when they announced their latest model in Japan—for many products, the crucible of competition is moving from Europe and North America to Japan. This is where the cutting edge of competition is, and unless you are there, and unless you are monitoring what is happening there, if you wait for that product to come to the United States and meet you in your own backyard, it is going to be too late. You will not be able to compete. And so while there is much improvement, I think, in the U.S. competitive situation, we still have a long way to go. And on the cutting edge, on the critical technologies, as the Council on Competitiveness has pointed out, it is still a very heated battle and it is not clear what is going to happen there.

In terms of long-range estimates of GNP, let me just say that Japan is now more than half as large as the United States, and if you look at long-term trends, by the year 2000 Japan will probably be somewhere around 70 percent—maybe even 80 percent, depending on what happens to the yen-dollar exchange rate—the size of the United States. This is an incredibly large economy, given the fact that it is just an island that is 75 percent mountains with a population half the size of the United States. And so this is something that no American business can afford to ignore. It is like ignoring all of the business in the U.S. west of the Mississippi River. I mean no business would do that.

And so in terms of how we are responding to this competitive challenge, I think it is doing a lot of good in companies but it is a culture change that is very hard to make.

Mr. MENDELOWITZ. It is true that some extremely well managed American firms are doing appreciably better today than they were at the beginning of the decade of the 1980's. Management systems have improved, management has improved, the exchange rate has changed to make it easier for American firms to compete on world markets, and there is at a certain level in industry a recognition that the old response to the issue of foreign competition—namely, if I haven't sold in Peoria, why should I try to sell in Paris?—doesn't wash any more, because now, if you can't sell in Paris, you are not going to be able to sell in Peoria either, because your foreign competitor is going to come and follow you wherever your markets are.

But with that said, there is one thing that we can't get away from, and that is, productivity of an economy, economic growth of an economy, depends very substantially on the rate of investment, the physical assets, and in nonphysical assets—education, human capital, R&D—and the rate of investment in the U.S. economy is just much lower than the rate of investment in Japan, and as long as the rate of investment in our competitor countries or a key competitor is much higher, then the advantages that they have will continue to grow.

As long as the Federal budget deficit continues to sop up a tremendously large portion of available loanable funds in the United States, the savings is not going to be there to fund investment, action from consumption is not going to be there to fund investment, and our prospects for the future will be considerably less bright than they could be with a more responsible fiscal policy.

Mr. CHENEY. I think both Dick Nanto and Allan Mendelowitz both summed it up very nicely; I don't have too much to add.

In critical technologies, we found the trends are still negative. The U.S. has some strengths in certain areas which shouldn't be underestimated, but the trends are negative, and there's also, to some extent, a vicious circle in that, to the extent that we lose market share in certain industries and profits go down, then the industries have less money to invest in the next generation of technology. So that is a negative trend.

Mr. BLOOM. My interests lie in how the economy handles spending on R&D. At the present time, the U.S. and Japan each spend about the same proportion of GNP on R&D, about 3 percent, in total, both government and private. However, the distribution of these funds is substantially different in the two countries.

I think you know that in Japan 80 percent of R&D spending originates in the private sector, as compared to 50 percent in the U.S. But the other 20 percent in Japan which comes from the government, a large part of that goes to the universities for the conduct of academic R&D, much more so than in the U.S.

On the other hand, in the U.S., the 50 percent of funding for R&D that comes from the Government, half of that goes to defense R&D. So it all depends then on how much credit you want to give to defense R&D in terms of its impact on the economy or on the growth of the economy.

Another figure of merit that is a little bit more elusive to come up with, but I think the trends are relatively clear, is, what proportion of revenues or sales private firms in each country spend on R&D. That percentage is increasing in Japan, because, as a matter almost of national consensus and certainly as a matter of national entreaty by the central government, companies are plowing back increasing proportions of profits into R&D and, more particularly, into the basic end of the R&D spectrum.

In the U.S., as Allan has mentioned, companies, when faced with declining market shares or sales, tend to cut back on R&D, which is considered the life blood of future market penetration in Japan.

The first thing one American company might do—not in every case, by any means—might do, is to cut back R&D because it is an overhead cost, it does not contribute to the bottom line directly, and if short-term profits in the quarterly P&L statement are important, R&D looks like a pretty good place to cut back.

The difference in attitude is very, very important and supports my view that it isn't just the technology itself that is important, it is the whole system that has to be addressed.

Ms. **Kotler**. There's really very little I can add. I think Dr. Nanto really summed it up.

Mr. **Lewis**. Thank you.

Mr. Chairman, just a couple more.

I would like to talk a little bit, Mr. Bloom, about the R&D. I totally agree with you and Mr. Mendelowitz. The first thing that happens even here at our level in the Government is, R&D gets reduced just as soon as we come out of budget constraints, which certainly is the life blood of our industry.

But you say that 80 percent—in Japan, 80 percent of their money comes out of industry into R&D, where we are only spending 50 percent, and one of the testimonies—I forget which one now—states that, very heavily, the government is very much involved in R&D with the universities specifically, where we are only at a percentage of that, and I believe that we have to come up with centers of excellence here in the United States in order to work toward a higher degree of competitiveness from the technological viewpoint.

You made a statement on page 10 that the worst mistake the U.S. policy makers and industrial leaders can make is to underestimate Japan's technological capacity and determination to succeed. I totally agree with that. And your next statement is, "By giving

Japan greater credit for its achievements and treating the country with more respect and less suspicion, Japan can be drawn into an even closer scientific and technological relationship with the U.S. to our advantage." I would like to explore that statement with you just a little bit.

How do you feel that, or how do you think that we could work with Japan in order to have a closer scientific and technological relationship with them which would be to our advantage?

In some of my personal dealings with them, it is like running up against a wall.

Mr. Bloom. Well, sir, I guess every person has his own impression, and I don't—I can't speak for every view. In my own case, I spent six years in Japan as the science counselor at the American embassy and had a chance to meet literally hundreds, maybe thousands, of Japanese scientists and engineers, but, more importantly, I arranged visits to Japan by large numbers of U.S. delegations of scientists and engineers on programs intended to carry out cooperative R&D in many, many different fields—typically, though, noncompetitive fields, fields such as environmental control, basic research, truly basic research, natural resources development, forestry, fields like that, where there were no competitive hang-ups on either side.

These kinds of cooperative relationships have been extraordinarily valuable, they have been long lasting, they have been nonthreatening, I would say. They are usually overlooked also by everybody, because they don't address this problem of competitiveness.

There are good opportunities to continue this work, this kind of thing, in other fields, and the Japanese recognize and state openly that they believe that they have a debt to the world—and when they say "world," they really mean to the United States—for the enormous amount of scientific and technical information that they have absorbed from the U.S. and want to in some way try to return the favor, but we have been very reluctant to engage in any activity that smacks of industrial technology.

For example, one recent proposal by Japan—by MITI, in fact, by the Japanese government—has been to establish an international center for developing intelligent manufacturing technology. It is called IMS—Intelligent Manufacturing Systems. The Japanese are world leaders in this field. The U.S. claims that we still retain the lead in the software required to run these highly computerized manufacturing systems. As a consequence, the U.S. Government has been extremely reluctant to accept the Japanese proposal, which would have involved Japan providing something like 80 percent of the funds for creation of an international laboratory essentially, a center, for carrying on this work.

Well, this initiative was taken by the Japanese over a year ago, and debate continues in Washington on how, when, or whether the U.S. should participate. I am not privy to those internal discussions in the U.S. Government, but I think maybe an accommodation is being reached. I hope so, at any rate.

We are enormously suspicious of any effort by the Japanese to take an initiative that involves industrial science or industrial technology, and I could give you other cases but I don't want to prolong this discussion.

This is what leads to my statement which you extracted from my testimony and which appeared originally in a major study I did in which I tried to bring people's attention to the fact that if we could just take a more wholesome attitude and not be so chauvinistic or, in some cases, xenophobic about Japan, we had a chance to learn something, but you can't do this if you still believe in the NIH syndrome and think that we have invented everything and that we are so far ahead of Japan that we have nothing to gain by dealing with them.

Mr. LEWIS. How do you feel that we can breach the cultural, political, and economic differences in order to have technological cooperation?

Mr. BLOOM. If I knew the answer to that, sir, I'd run for Congress.

Mr. LEWIS. Well, we in Congress don't have that answer either. At the same time, this seems to be one of the great problems. We can make the statement that we have to reach them, but we don't know how, and I think in order to do that it takes a cooperative arrangement on both sides, which I don't see at this point, and I just—maybe some other Members.

Yes, sir, Mr. Cheney.

Mr. CHENEY. Yes. I'd like to make a couple of comments. One is that if Japan is better at commercializing technologies than we are, then if we share technologies, they will tend to be able to bring it to the market faster than we can, and, in a way, they will get an asymmetrical advantage, even if the agreement is symmetrical. That is not a reason not to enter into agreements, but we need to make sure we are improving our commercialization process so we can take advantage of them.

The other point I wanted to make was that in many cases Japan's process of developing these proposals for agreements includes a lot of industry discussion, so that their industry is completely involved. On our side, we haven't really had a mechanism for getting industry's feedback on whether these proposals are a good idea and whether industry will benefit from them.

I think in the IMS proposal, which Justin Bloom mentioned, one of the things that is taking us a long time is, we are really developing that process for the first time among industry, getting industry to talk and debate about whether the proposal is a good idea, how we can best participate in it so that it will benefit our interests. I think that is very important, and I think we need to do that in a lot of these initiatives as they come up—develop a consensus among industry here and get industry input into it about whether that makes sense for us.

Mr. LEWIS. Thank you.

I notice that over the past several years there has been an award by an American that came up in Japan called the Deming Award for quality and production, and only one company in the United States has won that award. Other companies in the United States of any magnitude really don't compete for it. Could you—you know I'm speaking of the Deming Award. Could you respond to that?

Mr. **Mendelowitz**. Well, foreign companies weren't eligible to compete for the Deming Award until the mid-1980's, so while the award has been around for a long time, there was really no basis on which a foreign company could compete. When it did open up for competition, as you correctly pointed out, there was only one American company that set it out as a goal, changing its management structure and being able to compete for the Deming Award and win it, and that's Florida Light and Power.

One of the things, I think, maybe that militates against applying for it is, obviously, the complexity of applying internationally; and, secondly, in the time horizon that foreign companies were being made eligible for the Deming Award, the United States created its own and, I think, appropriately respected award for quality, the Baldrige Award, and the efforts of U.S. industry to gain recognition for their quality improvement processes have been sort of caught up in the application process and getting ready to qualify for the Baldrige Award.

Mr. **Lewis**. Mr. Chairman, you have been very generous with the time. Thank you very much.

Mr. **Valentine**. Thank you, sir.

The chair recognizes at this time the lady from Missouri, Ms. Horn.

Ms. **Horn**. Thank you, Mr. Chairman, and thank you to the panel. Their papers and testimony have been very informative and interesting and troubling.

I'd like to follow up, Mr. Cheney, your comments about our Federal laboratories, and you do have some—you sort of lightly go over some suggestions. Could you elaborate on that for me, how that might actually happen and if there were legislative changes, or is that also part of a culture that requires something, a more systemic kind of change, to happen?

Mr. **Cheney**. As part of our process of preparing *Gaining New Ground*, we had an advisory committee of top level people from industry, and they felt very strongly that the national labs weren't providing the kinds of benefits to industry that they would like to see, and the question was how to change this. Many of the people felt that, ideally, we'd try and—where Federal laboratories no longer have as clear a mission as they once had, it would be good to try and either close or consolidate them and take that money and put it into institutions that have much better cooperative relationships with industry, such as universities, which have a good record of, you know, sending people out into industry and working together cooperatively.

There's also a feeling that these labs were, you know, a great national resource; they have great scientists, they have great facilities, and it was, you know—it can be very hard to close them or cut them back, and the first attempt needed to be to improve their working relationships with industry. And it's very clear that it's not just a matter of technology transfer, it's not a matter of taking technology that's in the labs and somehow getting it out to industry, but there needs to be a change in the culture of the labs. And we felt that for this to happen effectively, there has to be exchange of people between the labs and industry so that people in the labs—are exposed to the industrial culture and have a better idea of what's needed to make something fit the needs of commercial markets, and get people from industry into the labs, as well as to get people—get industry's input into the research and development processes at the beginning of the process rather than at the end. The best time to make an R&D project more relevant to commercial markets is really at the beginning of the process rather than at the end of the process.

I guess, you know, we haven't developed any specific legislation, but we'd be happy to work with your staff on some ideas.

Ms. HORN. What efforts are under way? You had a group meet. What kind of implementation, or what's the follow-up of that process?

Mr. CHENEY. One thing that I think we plan to do is have some meetings between our members from industry and some people from the national labs, and get them together in a room and then talk about the problems so they can each address the—each address the other's—each institution can address the other's perspective of them and talk out some of the problems and figure out some of the best ways to go.

Ms. HORN. And that will be ongoing. Does something need to happen to make that—

Mr. CHENEY. That's something that we'll be doing, yes.

Ms. HORN. That process—I would be interested in more information at some point.

I also note that in several of the testimonies—or in the papers, not so much in the testimony, education, education, education, Mr. Bloom especially also talking about the university structure and how it is not the most efficient for what we are trying to do here and what we are speaking about this morning.

Would you elaborate on that, Mr. Bloom?

Mr. BLOOM. Yes, Ma'am. I was particularly critical of the Japanese university environment, which I consider to be the one weak link in the whole knowledge structure of Japan. The system is archaic in Japan, it is not a major contributor to the growth of the Japanese economy. On the other hand, it has made its own accomplishments, because when you look at Japanese society, you find a society that is estimated to be between 95 and 99 percent literate in a language that is difficult even for the Japanese to read and to speak, and the educational system inculcates in the Japanese people a great sense or a great desire for learning, and this carries through into the whole business structure.

The university plays a different role in Japan than it does in the United States, because it is not the source of great creativity and innovation in terms of commercial technology, but it certainly trains the engineers, the bachelor's and master's degree engineers, that go out and participate in the work force, as I had described earlier. The industry itself takes on the responsibility of taking the best young people who enter industrial concerns and educates them through internal research and training institutes within the large companies or sends them abroad for advanced education and perhaps research training. So the system is much different.

One of our strengths is our universities. We have the best universities in the world; everybody recognizes that. They are prolific producers of new ideas in all fields, and they are the places where most of our Nobel Prize winners have worked.

But American industry, in just some recent information that I saw, indicates that it is displeased, generally speaking, with its relations with universities, feeling that the universities are not attuned to the needs of industry sufficiently. Well, maybe not, but the situation here is far better than it is in Japan, where there is almost isolation between universities and industry. We hear so much about the marvelous sense of consensus and cooperation that exists in Japan, but the one place where it doesn't seem to be very good is between universities and industry.

Ms. **Horn**. Perhaps that is a weakness we could take advantage of by strengthening the relationship between our—do you not see any validity to that complaint on the part of industry?

Mr. **Bloom**. Absolutely, I do. That is one of our strengths, and we shouldn't ignore it, and we should build on it, but by making our universities even more integrated into the needs of industrial society particularly.

What I am concerned about is the trend that we are observing in American universities which is really disturbing, and that is—there are two trends we need to address: a steady decline, gradual, no severe, in the number of students taking science and engineering—majoring in science and engineering curricula. I think that is a discouraging trend.

The other trend we see is that in graduate schools in the United States, there are increasing enrollments of foreign students, to the point where, if you look at the major research universities of the United States, the 100 or so major universities—the names are familiar to you—typically 50 percent of enrollment in graduate schools in these universities are foreigners—not Japanese by the way; that's commonly misunderstood; Japanese are a relative small proportion of those graduate students. Most of the foreign students come from China, Taiwan, India, Korea, and many other countries in Asia, and from Europe. Those graduate schools would be in dire circumstances today if the foreign students suddenly withdrew themselves from getting that advanced American education. The graduate schools would not have the financial resources to continue in operation the way they are now.

One reason for this is because of this declining interest in science and technology by American undergraduate students. They want to go into law, they want to get MBA's, and to enter other fields where they see that they can command a salary twice that of a graduate engineer, who is reasonably well paid in the U.S., by going into one of these non-technical fields. So, again, that is part of a mentality, a national mentality, a national cultural—evolution—that is going on here that, I think, may tend to act against our overall national interests.

Ms. **Horn**. I certainly agree with you that it would have.

Have you also seen the statistic on how many of those foreign graduate students happen to stay in this country and how many of them go back?

Mr. **Bloom**. Depending on how you look at it, it may be fortunate that the students from some foreign countries tend to stay in the United States if they possibly can. That is true for India, for China, and a number of other countries. Japanese graduate students, almost entirely, return to Japan, so there is no residue of Japanese scientists and engineers of any magnitude here in the U.S.

Ms. HORN. I think we all understand the situation doesn't begin at the university level with science and math nor perhaps even at the secondary level, and I think that is probably a topic that might be too large to tackle here, so I'll turn back.

Thank you, Mr. Chairman.

Mr. BLOOM. I wish Ms. Horn would pursue that further, though, because at some time in another hearing, because this is, as my testimony and other writings have shown—I think this is where we have a critical weakness in the United States.

Ms. HORN. Well, I certainly do too, and I think this particular panel and perhaps others probably have a lot of ideas about that, and it is just probably a whole separate session, Mr. Chairman, in terms of responding perhaps to the recent education strategy and then how that might be enriched, or changed, or refocused, and how to take advantage of what we have, and I would enjoy that myself, if that is a possibility.

Mr. VALENTINE. Thank you.

The chair recognizes the gentleman from Arkansas, Mr. Thornton.

Mr. THORNTON. Thank you, Mr. Chairman, and first let me congratulate my colleague from Missouri on the excellent line of questioning and associate myself with her thoughts.

I also want to suggest that this hearing may be the most important hearing that is being held on Capitol Hill during this week and maybe one of the most important during this session of Congress, because addressing the problems of American competitiveness during the balance of this decade and setting a plan into effect to make us the dominant economic power in the beginning part of the next century is a matter that is going to take a great deal of effort, going to take a great deal of wisdom, and vision, and leadership, and I want to congratulate the witnesses, who have brought to us their perspective of the elements that we find in Japan which have helped them accelerate so greatly their own ability to move inventive genius into the marketplace.

However, I think that the witnesses would likely agree that we should not seek to replicate that Japanese success here in this country. When the Japanese were simply imitating American products, they didn't do very well. The pre-fifties products were only imitations of American products, but when they went on their own and sought to develop for themselves a plan, a strategy, a means of achieving national goals, it made quite a difference, and it seems to me that each of you would probably want to join in emphasizing that the idea is not to replicate Japanese successes but to step back and discover what we should be doing in this country in order to attain similar successes for ourselves.

May I have your comments on that?

Mr. NANTO. I would certainly agree that the United States is a world leader, has been a world leader, and will be a world leader in all areas, including the marketplace. And so, while the Japanese are leading in certain areas, they always look to the United States for leadership, for technological developments, for innovation especially.

However, the world nowadays is developing very rapidly into three major industrialized markets—Europe, North America, and Japan and its neighboring countries in east Asia—and so in order for an American firm to be competitive, it has to have a presence in all three markets. Although we can go our own way, we need to monitor what is going on in Japan and tie into that system so we don't have to reinvent the wheel.

Mr. THORNTON. Oh, I hope I did not suggest that we should go our own way. I think the time is now to develop a comprehensive strategy for America. Tim Roemer and some of my colleagues and I have been calling it a Marshall Plan for America, not to try and plug somebody else's ideas in but to step back.

Dr. Bloom's statement that he thought we should have a comprehensive approach to studying our relative strengths and weaknesses was important, that we needed to understand the complex relationship between capital formation, interest rates, reduction of Federal budget deficit, anti-trust laws, education, training of the work force, Government against, or I would say maybe Government cooperative with private support of research and development, the marketplace, the complex mix of things that must be addressed in a careful, thoughtful way, just as at the end of World War II the United States, in two and a half years, spent $11.5 billion on welfare and emergency aid to Europe. During that two and a half years, nothing happened to the European economy, but at the end of that time an idea of a comprehensive systems approach, called a Marshall Plan, was developed, which had a limited duration, three and a half years, and which expended over that three and a half years $13 billion in a coordinated and effective way, and it transformed Europe. It enabled them, through planning and careful analysis, to begin the track—and a similar track followed in Japan—to become competitive.

My question ultimately is, isn't it time that we develop that kind of vision and overall leadership in this Nation to develop for ourselves a pattern for being competitive as we enter the next century?

Mr. MENDELOWITZ. Mr. Thornton, I think your point is extremely well taken. When we were the unchallenged leaders in the world, we didn't have to worry about that, but we no longer have a monopoly on the world's capital, the world's technology, or the world's wealth, and maybe we need to do things better than we have been doing them in the past, and I also agree that, when we find our path to this, it has to be a unique path that reflects the traditions, laws, and special characteristics of the United States.

But with that said, one thing that we shouldn't ignore, and that is, there are lessons to be learned from the Japanese example that transcend the things that are peculiar to Japan—responsible fiscal policy; government policy that lowers the cost of capital rather than raises the cost of capital is important; maintaining and expanding our infrastructure; improving our education; and, in terms of the private sector, learning, really, not from the Japanese but from the American masters who taught the best managed Japanese companies how to do what they do well, the men like Dr. Deming and Dr. Juran.

These are not efforts to copy Japan, these are efforts to recognize, I think, realities in terms of what makes us competitive that are universal in their application.

Mr. **Thornton**. I had a delightful dinner with Dr. Deming just a few days ago, and I agree that we should try to learn from the experiences of others.

Mr. Cheney.

Mr. **Cheney**. Of course, the Council agrees very strongly with you that we need a major effort to improve competitiveness, and the Council, I think, has been working towards that in a number of areas.

I think we feel that the issues are fairly well known at this point and what it really takes now is implementation to get the ideas that are out there and take some action on them, and the Council is really shifting its focus from doing more studies to working towards implementation of the ideas that are out there.

Mr. **Thornton**. I agree that the problems and the data is well known, but I am suggesting that what is now needed is a comprehensive plan, an approach, a dynamic strategy in order to adjust ourselves to the realities of the world, is what you all probably are focusing on. Is that—

Mr. **Cheney**. Yes, and it is clear that it is going to take a lot of leadership both in the Government and in the private sector to accomplish these cohesive strategies to improve our competitiveness.

Mr. **Thornton**. Absolutely.

And I apologize for just lifting out of your written report some language that I think really nails this issue. I wish you would expand on it.

Mr. **Bloom**. You do me credit, sir.

Obviously, I support your contention, and I certainly agree with you that we don't want to, nor do we need to, just try to copy what Japan has done. That would be a terrible mistake to do. Unfortunately, there are some people who are suggesting that we do just that, at least in certain areas, and that won't work. We have a different culture, a different structure to our economy, as has been pointed out. There is no way that we can just use Japan as a model in entirety.

I like to hearken back to what I said a few minutes ago to Mrs. Horn, and that is that if we are going to start some place, we ought to start at the beginning and not expect overnight miracles. There is a huge inertia involved in changing the path that a country of this size is following, and we are not in wartime, we are at a time when, in order to keep from resorting to authoritarian measures, we have to do this on a voluntary approach, so let's start someplace.

To me, the thing that has the longest lead time is education. It takes 12 years to get through secondary school any way you cut it, so even if you start today, you are going to have to wait 12 years before you see the first graduate that emerges from a changed educational system, at least as far as primary and secondary schools are concerned, and that is where our weakness is, not in universities.

So why don't we start? Well, there's lots of rhetoric, lots of exhortation, and no action, and, you know, if somebody could come up with that $11 or $13 billion that you talked about for a Marshall Plan in the late 1940's, that's the equivalent of about $100 billion a year today in spending power.

So if we had resources like that—and, we might have to compromise a bit on how we manage a national program to revitalize the secondary schools, and with maybe greater involvement of the Federal Government, because it would be presumably Federal money that would be spent—maybe we could do some good in 12 years, but if anybody expects that we are going to see it, you know, in five years or even 10 years, I think they just don't understand the situation.

Mr. THORNTON. We have to begin now if we are going to enter the next century as a strong and vital, driving economic power on which we can support our greatness as a country which supports the ideas of democracy and individual freedoms and responsibility. I agree completely.

I'm glad you mentioned the funding level, because sometimes we forget that at the end of World War II we had a national debt of over $260 billion and an annual gross national product of $212 billion. Our debt was considerably above our gross national product. Yet, heavily burdened with debt as we were, we expended 2 percent of our gross national product for a Marshall Plan for Europe. Altruistic, yes, but also in our interests, because we needed to stabilize the European continent. Two percent.

Today, $3 trillion of debt is frightening, but over $5 trillion in gross national product, much less debt compared to GNP than we had at the end of World War II. What we had at the end of World War II, though, was a "can do" spirit, an attitude that America can succeed, that we're going to move ahead and work our way out of this situation, and so 2 percent of our GNP today would be over $100 billion, to be applied, I think, in a coordinated, comprehensive program addressing Americans' needs so that we can harness the "can do" spirit that we have reemerged with as a result of the successes of our Persian Gulf war and that now is probably the time that this country could accept that challenge.

Do you want to add any comments to that? I'm sorry, I didn't mean to make a speech. I'm supposed to be asking a question, but—

Mr. BLOOM. Where do I sign up?

Mr. THORNTON. All right. Well, we need your help. I think we need to insure that as we go through the appropriations processes, that we call attention to the need for new thinking, for providing funds at levels where you are not simply matching up with a specific ad hoc situation but providing funds for planning and for creative ideas.

Ms. Kotler.

Ms. KOTLER. I simply cannot agree with you more, and it's a good observation, and I hope it's a good project. Not only do we need, I think, the "can do" spirit but the "must learn" spirit, and that we cannot continue with the same old assumptions.

Just a brief little story: Last summer, I had the son of a prominent Japanese politician as a house guest, and his first question to me when he came to my house was a question I would never have asked in the capital of Washington, D.C., or Bonn, or Paris, or London, or Tokyo. He simply assumed and simply asked, "Can I drink the water?"

Mr. THORNTON. Beautiful. A wonderful story.

Mr. Chairman, I've used more time than I intended.

Mr. VALENTINE. Not at all. Thank you, sir.

The chair recognizes at this time the gentleman from Indiana, Mr. Roemer.

Mr. ROEMER. Mr. Chairman, I'd just like to commend you for this hearing.

I agree with my colleague from Arkansas and want to associate myself with his eloquent and articulate remarks about a Marshall Plan. I also want to associate myself with my colleague from Missouri who talked about the need for education, more thorough education throughout our system, and I hope to get into that in a couple of questions here, if we don't have to leave, and I'd also like to salute and thank everybody here for their excellent, articulate, and cogent testimony.

It's good to see Dick Nanto again, too, whom I traveled with when I was on the Senate side, and staff, and his very concise and well put together remarks were excellent and will cause much work for my staff to go through when I go back and have them go over that. Hopefully, you could come in and talk to us more, too. I really enjoyed your remarks, as well as everybody's.

I'd like to talk for just a quick second, too, about this Marshall Plan. I just returned from my district, and I spent the recess in town meetings, and while we are all very, very proud of this accomplishment in the Persian Gulf and it has led, as my colleague from Arkansas said, to a new spirit, a new understanding, I got one question with averaging between 70 and 140 people in my town meetings on the Persian Gulf. Questions were about trade policy with the Japanese and the recent incident with the rice. Questions are about our businesses spending $30 to $40 billion a year retraining our students. Questions are about education and why our kids are dropping out once every eight seconds of the school day. Questions are about lost jobs in my district. Where we used to pay people $12, and $13, and $14 and hour, now they are working two jobs at $4 and $5 an hour, and they can't get their kids in day care or they can't afford health care. These are fundamental problems that we had better start working on.

As my colleague from Arkansas said, we had better come up with some funding pricrities for our children in this country, where one in five is born in poverty in the wealthiest country in the world. We have got to make some new decisions and some new thinking here.

I would also say that just a couple of days ago I urged this committee not to give NASA a 10 percent increase but to give them a more modest increase, a 5 or 6 percent increase, and come up with some of this money for our schools, for a new manufacturing or trade policy, for a Marshall Plan, so to speak, that we need in this country to compete economically and internationally, and I hope to continue to raise that concern with my colleagues.

I, too, would like to get into a couple of specific questions, after making much too verbose an opening argument there.

A recent study made by the National Center for Manufacturing Sciences—and I'd like to get into the manufacturing part of this and ask the panel—they say the crux of the problem is that U.S. research proceeds without any kind of market focus, that we have success in the laboratories and not success in the marketplace, that we are not having any part of the D; we are strong on the R and weak on the D.

They also say that useful technology never even reaches the factory floor because U.S. manufacturers with limited hard assets can't secure the capital they need to modernize their efforts, and they say 90 percent of U.S. manufacturing is done by companies of 30 people or fewer and with annual sales of less than $4 million.

How do we begin to address the transfer of new technology and knowledge and help to apply this available technology and know-how manufacturing, like the VCR or magnetic levitation trains, to our commercial base?

Dick, do you want to start?

Mr. NANTO. Yes, thank you.

When you look at a product cycle, it starts out with an invention, some very basic research, continues on with some development, then reaches a point where it has to be commercialized, and what you find is that the point of commercialization is the most risky and the most expensive relative to expected returns of any of this whole process. Once you have a commercial product, then developing that product and giving it features that will sell, and advertising and manufacturing is relatively easy. But the return on investment for the commercialization step is usually very low, and there is a high risk of not getting anything out of this, and many times you almost have to bet your company, the company's assets, on this process. And so one thing that we can do and one thing that Japan has done that we can, I think, learn from is to somehow organize the commercialization process so that there is less risk involved.

Now the reason that many American firms find that they do not commercialize the technology that they develop is just because the return on investment is just too low for the bean counters who are in the comptroller's office. What happens in Japan is that, when there is an emerging technology like robotics, the government will organize an industry association around that technology before the industry even exists, so there will be a robotics institute or robotics association, and they will provide some funding from the government but most comes from private businesses who can gain from this commercialization of this technology.

The association then gathers information, which Mindy has talked about; they will provide information on patents. There will often be a joint R&D project. And, in the joint R&D projects, usually what happens is that the individual companies who are participating in this will duplicate the research of the R&D project, so that when the project is through, they are on board, they know all about it, and problems that they have found in commercialization will be solved by the joint R&D project. Once the commercialization step is complete, then all the companies go their own way and make their own products. And so one thing we can do is to try to organize industries that are trying to commercialize these technologies and also to make sure that our companies are in Japan so that they can join these associations and benefit from the information that comes out of those projects.

Mr. **Roemer**. Dick, that is similar to what happened in 1986 when two IBM scientists discovered some of the materials for superconductivity and then a Japanese, within a matter of months, had put together a 45-company consortium and 50 scientists to work full time on the job.

Do you have specific ideas as to how we encourage that process, or are there disincentives there for our companies or laws that prevent that now?

Mr. **Nanto**. I think there is no mandate now in, for example, the Department of Commerce to actively participate in organizing these sorts of associations. So without a mandate most bureaucrats tend to prefer not to do anything, because it is very risky to stick your neck out and do something that you don't have a mandate for. So we might first look at the mandate in our Government to participate with businesses in doing this.

We also need to make sure that, in Japan, our businesses who are there and have a presence, like IBM and like Texas Instruments, can participate in Japanese associations, and they have been opening their research more to foreign participation.

Mr. **Mendelowitz**. I would like to—so as not to be repetitive with what Dick had to say, I'd like to talk about two other issues, and one is getting back to the issue of cost of capital, and the second is the issue of quality of management in the corporations themselves.

If I'm executive of a corporation and I have a dollar to invest, and a product development manager comes to me and says, "If you invest your dollar in my project, I guarantee you, 10 years from now, you'll get back two dollars," is that a good business opportunity? Well, whether that is a good business opportunity depends on what the cost of capital is. Getting two dollars back in 10 years is a very good investment if the cost of capital is 5 percent, it is a very poor investment if the cost of capital is 10 percent, and there is just no way you can get around that. No matter what you do on the micro level in terms of Government programs, you can't get around the fundamental disincentive associated with having a cost of capital that is high as compared to cost of capital that is low, and given the importance of macro-economic policy, the budget deficit, tax policy, in determining the cost of capital, we have to take seriously the impact of the budget deficit, and our fiscal policy, and our tax policy on the cost of capital and how that flows through to competitiveness. We have to deal with it. You can't deal with competitiveness and ignore that issue.

Mr. **Roemer**. Allan, do you have one basic recommendation or specific recommendation for addressing that from a Congressional point of view with tax policy, monetary policy, or macro-economic policy, as you call it in your remarks?

Mr. **Mendelowitz**. I would have to speak personally rather than as a representative of the General Accounting Office on that score. I don't think the GAO has put together a package that says, "Increase the following taxes, and reduce the following spending," but the General Accounting Office has come out very strongly in favor of a substantial reduction in the budget deficit and a more responsible fiscal policy.

Frankly, what is the best way to do that is really a political question—you know, how do you put that compromise and coalition together that inflicts the least pain and gets the most bang for the buck? I personally am not opposed to a value-added tax, for example, and I realize that is a real political hot potato.

Mr. ROEMER. I'll let Ray answer that one.

Mr. MENDELOWITZ. This issue of cost of capital, I think, goes directly to the question the chairman asked when his time was up. He asked about takeovers in the United States versus Japan. Well, it is true that by tradition you don't have takeovers in Japan—you don't have hostile takeovers—and you do in the United States, but there is no law mandating hostile takeovers in the United States. The fact that they are permitted by law and by custom doesn't mean they have to take place. They take place because there are economic incentives there, and the economic incentives are actually tied to the fact that, given the cost of capital in this country, many good managers use a time horizon that is too long.

Why does someone engage in a hostile takeover? They engage in a hostile takeover because they believe they can get more value out of a company than the current management. Well, if the current management isn't good at running operations, the new management may get more out of the company because they manage the operation better in terms of efficiency of production, but most of the time you get a hostile takeover when the takeover company or the takeover individual sees an opportunity to reduce investment in the target takeover company and increase its current value, and the way they do it is, they cut the long-term investment projects like R&D. You buy the company, you cut those long-term investment projects that aren't justified given the current cost of capital, you raise the value, you get out, and you make a lot of money. You lower the cost of capital, and you take away the incentive for the market correcting action of the takeover artists who can get more value out of that company by shortening the time horizon of the leadership.

And then the second issue I wanted to talk to, again, is the importance of the quality of management and the management systems that the companies use. All good companies aren't located in Japan, and all poorly managed companies are not located in the United States. There are some very well managed companies in Japan and some very poorly managed companies in Japan. We don't see the poorly managed ones, because they never get out of Japan, we only see the best ones, and we have in this country, obviously, some extremely well managed companies, and worldwide well-managed companies do the same thing. They listen to the customers, they identify the customers' needs and desires, and they work vigorously to, as quickly as possible, satisfy those needs and desires. The current term being used, I think, is "listening to the murmurs of the customer." Companies that do it well succeed, and it is no surprise that the companies that have done it well or the companies who have been identified and singled out for the Baldrige Award—take Motorola, for example, one of the first recipients of the Baldrige Award. This company has beat its Japanese competition in bringing the new product to the market first. Motorola was the first company to bring a coat pocket cellular phone to the market, two years before any of the competition. That is a well managed company, and that is in spite of the higher cost of capital here. It is a result of good management.

Mr. ROEMER. What market share does Motorola have over there on that? Because I know that the CEO of that company has also complained about unfair trade practices over there. If he has got 12 percent of the market share now, he claims that he could get 25 percent.

Mr. MENDELOWITZ. I don't have the specifics. Their share on pagers is pretty good, their share on cellular phones is substantially less, and, you know, Motorola is a company which has entered the Japanese market according to all the best advice that is always given to American companies who want to enter the Japanese market: Go in for the long term; work with the Japanese customer; demonstrate your long-run extent. And, to the extent that they still haven't achieved full market potential, I would not be surprised that it's a result of nontariff barriers.

Mr. ROEMER. Dave.

Mr. CHENEY. Yes. First of all, I would like to say that the National Center for Manufacturing Sciences' perception of the problem is quite correct. We found in our study that we are doing very well in the technologies where research can directly be translated into commercial products, such as biotechnologies or software.

The technologies we are having the biggest problem in are areas that are related to manufacturing and areas where it takes a lot of capital to get the product to the market.

There are several things that can be done now. One is that NIST's manufacturing technology centers help get manufacturing technology out to companies, and I guess the one in Ohio is working with lots of manufacturing machine tool companies in that area.

Another thing is to support organizations like NCMS and other cooperative industry organizations. They can do a lot to find the best available technology and get it out to their members. We think U.S. industry needs to do a lot more of this. U.S. industry organizations generally haven't been involved in this sort of thing. They have usually been involved in regulatory and other legal policies, they have been mostly lobbying organizations, whereas industry organizations in Japan have historically had a much bigger role in acquiring technology from overseas and getting it to the members and organizing cooperative research.

From the public policy standpoint, there are a couple of things that need to be done. The first is, some antitrust things need to be clarified. I think most people think that it is not really a problem, but a lot of companies are still uneasy about it, and it is just more a clarification of regulations that is needed than changes in law.

Another thing to look into would be, Japan has a number of policies that support cooperative research associations. They give favorable tax status to cooperative research associations that encourages companies to put money in them and cooperate.

The other thing is, the Council has another study going on which is looking specifically at the time horizons of american management, and the results from that are going to be out this summer and in the fall, and I think it will be very interesting. It says the cost of capital is part of the problem, but it is only part of it, and there's deeper things in the way U.S. industries are organized that affect the time horizons of management, and I think that will eventually have a lot of interesting policy recommendations from them.

Mr. ROEMER. Thank you.

And if you would like to touch more on education, I am a member of the Education Committee, so I would greatly like to hear your views there as well, if you want to come back to that, and if you want to talk about mentor programs, and worker training, and retraining, and how we bring the work place to school and school to the work place, feel free to comment on that as well, Mr. Bloom.

Mr. BLOOM. Another big challenge.

I would like to talk more about education, if that is in your and the committee's interest. Let me first try to respond to your original question to a much smaller extent than my colleagues have done.

Industry associations in Japan, I think, can be entered safely in this country provided that there is a will again, and that is where we always begin to stumble. When you say "industry association" in the United States, what comes to mind? The first thing you think of is U.S. Chamber of Commerce, National Association of Manufacturers, huge organizations made up largely of the upper tier companies.

In Japan, there are all kinds of industry associations, thousands of them, some of them local, regional, and there is a trend in that direction, in fact, to go more toward a regional approach to problem solving because of the need to better distribute the Japanese management of the economy away from Tokyo and get it out into the prefectures. That might sound familiar to Congressmen who have some of the same concerns.

So it isn't necessary to always talk about an association that is sponsored by MITI, although obviously that has somewhat bigger clout. But MITI sponsors probably 1,000 industry associations of all kinds. There are catalogues of these published, covering every conceivable subject, and not all of them technical. There will be industry associations looking at sanitary landfills or any subject, you name it.

So the idea is to get industry to work together with some prodding. MITI does not fund these associations. It usually contributes a small amount to the administrative overhead of them. The members of the association are supposed to pay their own way to a large extent, and now you begin to get into another kind of problem: How do you make this exciting enough to get American companies to do this kind of thing? It does take exhortation from the top. I like Dick's idea of Commerce taking the lead in this and making it a more official type of program, but if it is going to work, it has to last, long enough to see some effects, or people will quickly lose interest and drop away from this approach.

There is another kind of industry association in Japan that we get things mixed up with, and that is the research association that is created typically by MITI, not by other government agencies who don't use this concept to any great extent, and that is to do precompetitive technological development through a cooperative arrangement. In years past I have suggested that this has been a highly overrated field approach to the problem. More recently now, books are appearing and statements are being made by others that support my earlier contention.

MITI today acts as a cheerleader. It doesn't have much money. By our standards, the total MITI R&D budget, annual R&D budget, is about equal to the annual budgets of Lawrence Livermore Laboratory and Los Alamos National Laboratory combined, two laboratories out of the whole Federal laboratory system. They are two of the big ones, but MITI's national annual R&D budget is roughly equivalent to the sum of those two budgets.

Mr. ROEMER. Which is what?

Mr. BLOOM. About $2 billion.

So it isn't money, it is organization and pressure and with some arm twisting thrown in to get companies to work together in the national interest, looking towards long-range objectives. So that again means a national focus, a national will, a national determination, and I don't see that, frankly. I have been concerned about these critical technology lists, as you know from reading my testimony, because they tend to make it look easy. All you do is, you pick out the right technologies, and you develop them, and by magic everything falls into place, and I don't think that we are good at doing this, and it is not what Japan does, and we could go off on a divergent track that could really hurt us.

The lists are valuable, because they make people think about what technologies are coming up and what their implications are, but as far as a blueprint or a road map for getting from here to there, I have grave reservations about it.

Mr. ROEMER. I agree with you on that, too, Mr. Bloom. I recently met with Jack Gibbons over at the Office of Technology Assessment to sit down and talk to him about specific emerging technologies in energy-related and environmentally-related areas, and it is frightening where we are. It is encouraging where we are in some of them but frightening where we are in other critical technologies.

Mr. BLOOM. Well, you know, if you are behind, you face two choices—you try to figure out how to live with the situation or you try to catch up—and we have never been, in all of our own memories, even the oldest of us here, have never been involved in the catch-up mode; that is a phenomenon that occurred in the nineteenth century when we were trying to catch up with Europe. We have always been the leaders, and we have been unable to shift gears to reestablish a thought process that says somebody else is ahead and we have got to try to either catch up or adapt, and, you know, I don't have any magic answers as to which of these paths are the best, but I am suspicious of the catch-up process.

Mr. ROEMER. That is why we asked you here today, for a magic answer.

Mr. VALENTINE. I have to say, Mr. Bloom, and I don't mean to interrupt you; you can come back to it, but I believe that the Union has not been involved with a catch-up effort of any consequence since the Battle of First Manassas.

Mr. BLOOM. Eighteen sixty-one?

Well, the Union—in this case, you mean the national Federal union, the United States.

Mr. VALENTINE. Yes.

Mr. BLOOM. That could well be.

But I would like to talk about education for just a minute longer, because this is a place where I think the american people will join a rallying cry. You won't get some people saying we've got to do more on R&D or more on this or that, because these are esoteric and hard to understand and the implications are long-range. You know, it is hard for even the pros to handle all of this.

But when you say "education," then I think you could have a real rallying cry that affects everything else. Everybody wants their children to have a better education. Everybody in this country now know that our kids don't do very well compared to kids from other schools—other countries. So let's maybe use that as a rallying point to bring everybody together—Republicans, Democrats—everybody all together to improve the national education system, and, in doing that, one hopes that this will help address the drug problem and many, many other—the drop-out rate, obviously, and the effect that has on kids going into mischievous activities. You hope that it has an overall coalescing effect on the stature of the entire country. I can't think of any other single thing to do that might be able to pull everybody together.

Mr. ROEMER. Well, I would be happy to work with you in that area. I think that that is a rallying cry. Prevention, and health care, environmental concerns, the drug abuse resistance education program, international competitiveness, they all relate directly to education. So I would be happy to work with you in that area.

Mr. BLOOM. Thank you.

Ms. KOTLER. I just have a brief comment on the question of regulating risk. As someone who trained as a historian, this country has several times been in a catch-up mode, and particularly after December 7, 1941. We had no navy, we had no industry, we had no Pentagon building, we were completely in a catch-up mode, and, in fact, the idea of coordinating between industry associations and government, the idea of government and industry cooperating is the Commerce Department of 1945, which is what MITI was patterned after and continue to be patterned after, and many of you are familiar with the Committee on Economic Development. That is an industry association that was hatched and actually operated in the basement of the Commerce Department starting in 1942.

So it is a little bit more like us that we need to be. The element of coordination between industry and government is the element, I believe, that reduces the sum of this risk.

Mr. ROEMER. Thank you.

Mr. Chairman, I just want to thank you for your patience in allowing us to ask questions, and maybe at some other point in hearings we can ask people like Dick Nanto about this international trade revolution that he was talking about as well.

Thank you, Mr. Chairman.

Mr. VALENTINE. I appreciate that.

When I was in my first term, I lived through sessions of this kind where the chairman asked all the questions, and I know how that feels, and so I have tried to lighten up—maybe not, but I do appreciate that.

We are close to the end of it, I know, and I want to say to Ms. Kotler that I'm very sorry I didn't think of that example. You are exactly right. Pearl Harbor—everything you said was right, but the Pentagon did exist at that time, maybe not the people in it, but I think it was finished in '39 or something like that.

Mr. **Roemer**. Mr. Chairman, Sputnik was probably another one, but you being from Duke University, you know, you are not used to these come-back things at all.

Mr. **Valentine**. I know. I appreciate the opportunity to say something about that. There have been, I'm sure we think about it, and I think and wish that I had thought to say this earlier in the proceeding, what Mr. Bloom said about education. I try to miss no opportunity to say to business groups, and I'll say again to this business group, that there is in this country a so-called business agenda, you know, and you know what that is going to be before you even pull out the list and look at it. It is going to have something to do with minimum wage, and parental leave, and strike legislation, and those things, and I say to Chamber of Commerce groups and others in my district when I have my wits about me that improvement in American education ought to be at the top of the business agenda. Business in the State of North Carolina particularly ought to be urging, begging the general assembly to increase taxes to pay for improved public education.

So I think that we ought to—and it is a nonpartisan thing that has nothing to do with party politics. If we don't address the scourge of illiteracy in this Nation and the lack of educational opportunities, which goes hand in hand with the drug problem, if we had more opportunities for these people, they would not—some of these young folks, they wouldn't be on the streets.

I wish I could just sit here with all of you the rest of the afternoon myself, because there are so many questions; so many things come to mind about this.

I had someone hand me here a clipping from a newspaper of some prominence—it doesn't need to be advertised—a statement by Boone Pickens, a familiar name. Let me quote from that. This is something that, if this is true, that we don't—the Government should have addressed a long time ago. He says that, according to the under secretary of commerce for international trade, Michael Farrin, Japan exported more than $11 billion in auto parts to the United States during the past two years while allowing only $640 million worth to come into the country.

Ever since we have been plagued in this country by this problem that we have confronted here today, I have heard all kinds of horror stories about the unfair trade practices practiced by the Japanese. Now those, in the opinion of you gentlemen and lady—are those a bunch of fairy tales, or is that true? If part of what I have heard, stories about television sets that are allowed into Japan but they go through some kind of quarantine period, and they do all kinds of things to them, until they are no longer state of the art. What do you say about that? What kind of problem is it? Is that a myth?

Mr. Mendelowitz.

Mr. **Mendelowitz**. I think that we have to be careful how we characterize data that come out and events that happen. I think there is no question about it that Japan is a difficult market to break into. I also think that there is no question—

Mr. **Valentine**. Well, let me ask you—excuse me—right there, if Japan is a difficult market to break into, why shouldn't the United States be a difficult market for Japan to break into?

Mr. **Mendelowitz**. I think that that goes to the heart of trade policy, number one; and, two, I think before you answer that question, you have to figure out what the costs and benefits of that are; and, secondly, you have to figure out whether difficulty of breaking in is a result of government action, government-induced action, or private sector behavior.

For example, while Japan is a difficult market to break into for the United States companies, it is also a difficult market for upstart Japanese companies to break into, and if you look at some of the Japanese companies which are most well known in the United States—Sony in consumer electronics, Honda in automobiles, Keyosera in integrated circuit ceramics, other items—these are all companies which gained success in the American market before they gained any acceptance at all in the Japanese market. They were the newcomers, the new kids on the block, and they had a tough time breaking in. So that this issue of breaking into the Japanese market is not necessarily discrimination against foreigners; there are certain aspects of it that represent sort of, you know, difficulties for any new entrants.

The second thing is that when you look at the structure of Japanese industry, there is a lot of attention being focused now on the keiretsu, and a recent paper by Robert Lawrence that has been reported on—Robert Lawrence is a very distinguished economist at the Brookings Institution—raised questions about how the keiretsu affect the tendency of Japanese companies to import and determined that, in fact, there was some retardation of imports into Japan because of the keiretsu structure. But the keiretsu structure is horizontal in some cases and vertical in others, and in the case of, I believe—you know, I haven't looked at it carefully, I have just had a chance to peruse it quickly—in the case of horizontal keiretsu, there was retardation of imports that wasn't a result of economic efficiency. In the case of the sort of tighter vertical relations that you see, for example, in the automobile industry, what you are seeing is a form of organization that has substantial efficiencies associated with it, and it is not necessary, just blatant discrimination.

If you look at, for example, the American companies that have gone out to fully adopt the quality management models, one of the principles is a substantial reduction in the number of suppliers and the creation of a long-term, stable relationship with suppliers, and companies like Xerox and Motorola—again, companies who have won the Baldrige Award—are companies who, for example, have drastically shrunken their supplier bases, going from 4,000 to 5,000 companies down to maybe 300 or 400, and shrinking them even farther, and then creating long-term stable relationships with those suppliers because there were economic efficiencies associated with it. So you have got to worry about that.

And then, lastly, with respect to auto parts, I think it is safe to point out that when companies start manufacturing, the first thing they do is assembly, and as their scale of production gets larger, they manufacture more and more of the parts and components that go into their products locally.

The last half of the 1980's was a period when there was a tremendous ramp-up in capacity of the Japanese automobile industry to produce cars in the United States, and the first cars being produced here by a company had large amounts of imported components from Japan. The longer they are in operation here, the larger the domestic content became and the larger the scale of operation, the larger the domestic content became, so that those auto part figures that you quoted from the article talking about—by Boone Pickens also reflects, I think, the dynamics of investment in this country by the Japanese auto industry.

Mr. VALENTINE. Yes, Mr. Nanto.

Mr. NANTO. In trying to assess how protected the Japanese market is, I usually say that the market is more open than most Americans think and is, more closed than most Japanese think.

Clearly, international trade and protection is part of the total industrial strategy of the Japanese government. However, the Japanese government tends to intervene mainly at the beginning and at the end of an industry's life cycle. So they try to protect mainly industries that are emerging or try to give them some assistance in order to become internationally competitive. Then, once they become competitive, then they are left generally on their own, and the government does not pick winners or losers, the companies just do their thing and sell until they become a declining industry, and then the government again intervenes to try to have an orderly reduction of capacity, perhaps some protection, such as in soda ash and aluminum and rice.

However, there is this broad spectrum of industries in between that virtually anyone can enter the market, and it is a matter of that firm's competitiveness, and, unfortunately, right now, we do not have a large base of American cars being used in Japan, so there is no after-market for American parts, and we do not have American assembly operations there either, and so we don't have parts going into factories, and so there is a huge imbalance in auto parts, and that is one thing that definitely Commerce is looking at, and the USTR is also looking at.

Mr. VALENTINE. Mr. Bloom.

Mr. BLOOM. Mr. Valentine, it is so difficult to treat this subject of imbalance in trade on a product-by-product basis, because it varies so widely in the way things come out. For example, agricultural trade—I'm no expert in this area, but I know some of the numbers. The U.S. is Japan's largest—or let me turn it the other way around. Japan is the largest recipient of U.S. agricultural products, and we receive essentially zero agricultural products from Japan. There are some in the form of processed food products, but in terms of cereal grains and other agricultural products like this—

Mr. VALENTINE. That is true, but they just don't have much to export, though, do they? I mean what they grow in Japan, they need that plus all they can import to feed those teeming millions, don't they?

Mr. Bloom. That is right. Dr. Nanto gave the statistics on available land for any arable purpose in Japan, and it's remarkably low.

So the Japanese buy from the United States something like $9 billion a year now in agricultural products. I think it is probably the largest single item in the trade area. Is that right?

Mr. Nanto. Right.

Mr. Bloom. And it is all in our favor. So, you know, this is the place where the U.S. has a distinct advantage.

What happens if you say, "Well, Japan, you can't send automobile parts to the U.S. any more"? Then the Japanese say, "Well, we're not going to buy your corn."

Mr. Valentine. Not going to buy your tobacco.

Mr. Bloom. Or tobacco—tobacco would be a good one to talk about. And so then the U.S. faces a problem: Does it settle for that, and do all the farmers get upset then, or does it have to work out something else? Because there are other available sources of agricultural products that probably can compete very strongly with the U.S. on a price and quality basis. So once you start to get involved in something like trying to swap markets, you get into a hornets' nest the likes of which, I think, none of us would ever want to see.

Mr. Valentine. Yes, Ma'am.

Ms. Kotler. It is quite dangerous to do as Mr. Bloom says, to swap markets, but I somehow don't think that is the total issue. But what I want to just make one observation on—sort of the oddity of discussing this issue, that the company that, if it is like in the past who wrote T. Boone Pickens' article—if it is the same company that has written them in the past, it is the same public relations firm for the Japanese automobile parts industry, and they represent them here in the United States. It's a curiosity of information.

Mr. Valentine. It is. It is.

I don't want to bring down a shade of gloom over the proceedings. You know, we are here to find answers, and I believe that the chairman of the full committee, Mr. Brown, and I can speak for myself: I know that one of my principal aims in Congress is to try to do something about this problem. I believe that that is the feeling of the leadership in the House on both sides. I think that we have the attention of the executive, the President, and I think that American business is indicating now that it is willing to set aside its inherent, long-standing, innate suspicion of government and everything about government, and to walk hand in hand with us in trying to address the problem.

But—I won't say "but"—and there are certain things about it that are very discouraging, in my opinion. We are dealing with some things that we can change, some things we can't change perhaps. We have a very energetic, intelligent, and able, and aggressive race of people who inhabit those beautiful and tiny land masses, that would appear to be a somewhat domesticated labor source, whatever that means, and what has been described as the situation with the companies, either perpendicular or horizontal, sound to me like arrangements that could not exist in the United States with our antitrust laws, and as to what extent we can change, I don't know. You know, the antitrust laws were designed to provide other well known protections, and I think there's a need for them, and we have, if I understand it correctly, to say that you pay less interest means you get cheap money.

I mean if the interest rate is down, isn't that what we are talking about? Money, cheap money, is money that you get when you don't have to pay as much interest as you might pay some place else, and a tax burden that has to be much smaller than is imposed on American corporations, because Japan has been able to develop since World War II without any concern for its national defense, when you consider what we have here in the United States. Our taxpayers have to consider taking care of public education in this country, and research and development, and all these other things, the infrastructure, plus defending the whole Free World, including Japan.

So there would appear to me—and I wonder if you agree—that there are going to have to be a lot of drastic changes in a lot of different things before we ever get into a situation where we can compete again with the Japanese.

I would like to and will likely submit some questions to you. I want to say also without objection, because there is nobody left here to object. We arranged to handle that. The lady from Missouri has questions she would like to submit for the record, and other Members might very well do the same thing. We would appreciate it if you would respond, and if anything occurs to you when you leave here—I've said this before. I'm sure this does not apply to people with your degrees and your background, but in my other life I was a country lawyer, and I oftentimes made the best speech to the Supreme Court on the way back home. When you have departed, if anything, any pearls of wisdom occur to you that you didn't lay on us, please send them back, and we will get back in touch with you. We will have other discussions of this kind.

I thank you all very much. The subcommittee stands adjourned, or recessed.

[Whereupon, at 12:34 p.m., the subcommittee was recessed.]